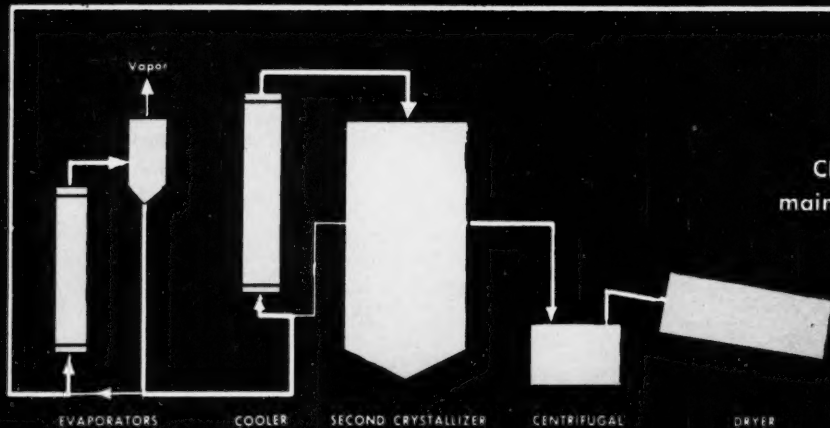
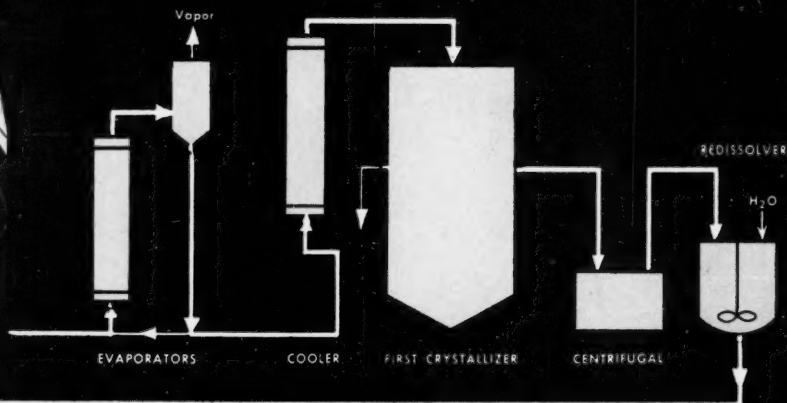


OCTOBER
1952

Chemical Engineering



SILVER DISSOLVED IN HNO_3

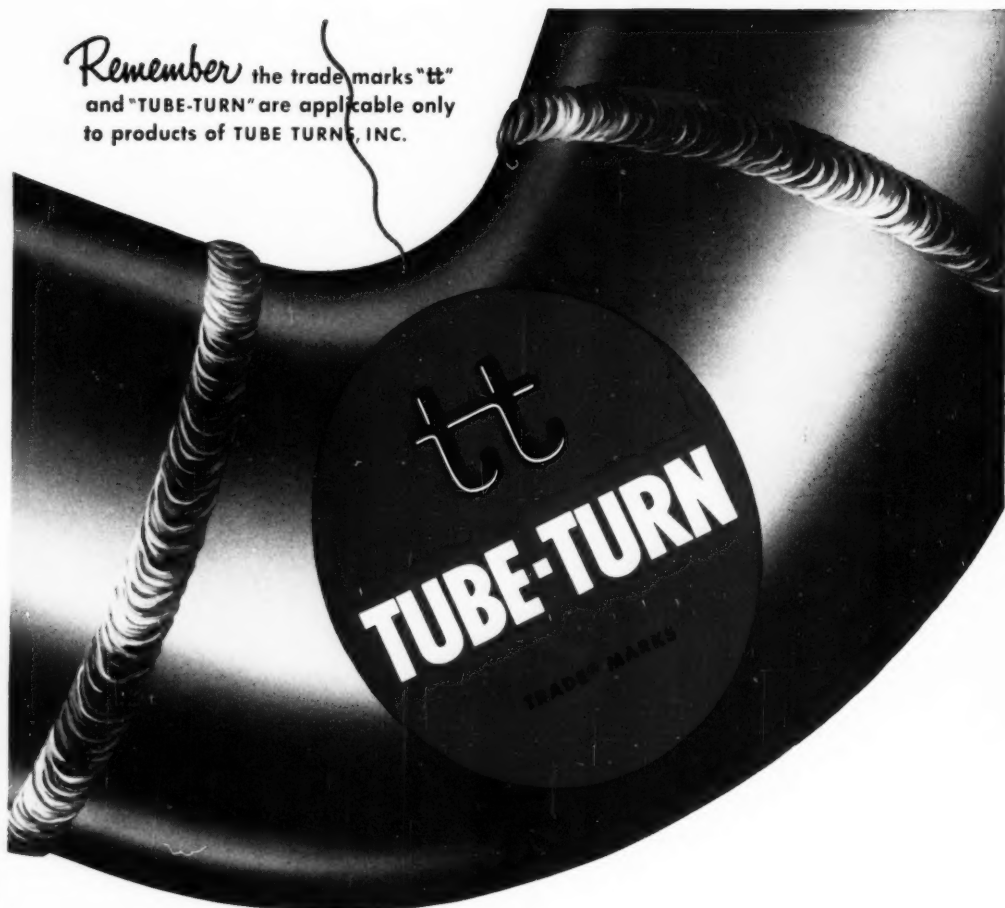


Clever engineering
maintains top quality
in making
crystalline

**SILVER
NITRATE**

See page 217

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Engineered to save maintenance manhours



Scrappy says,
"Aid defense—more
scrap today... more
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OCTOBER
1952

Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

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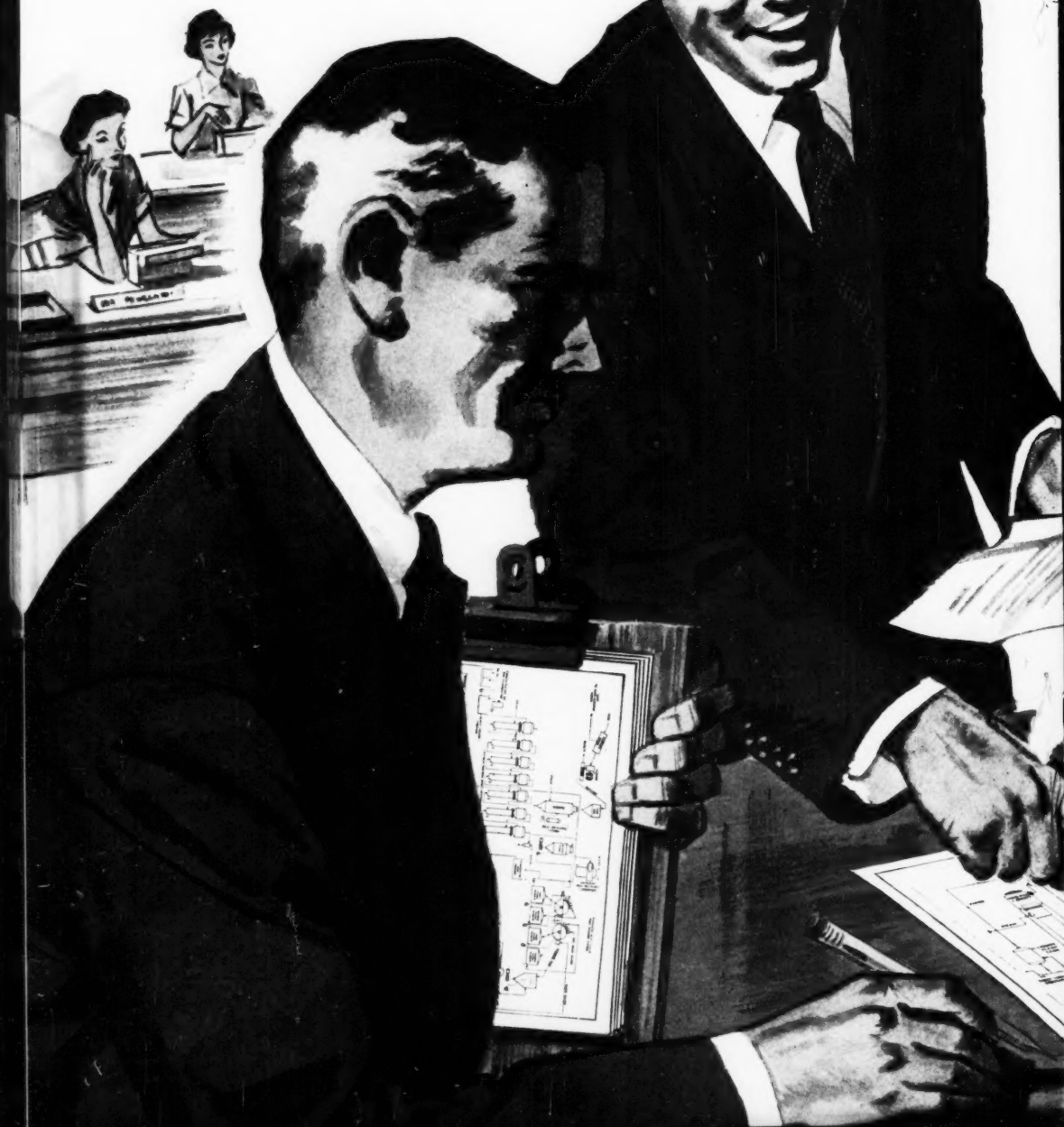
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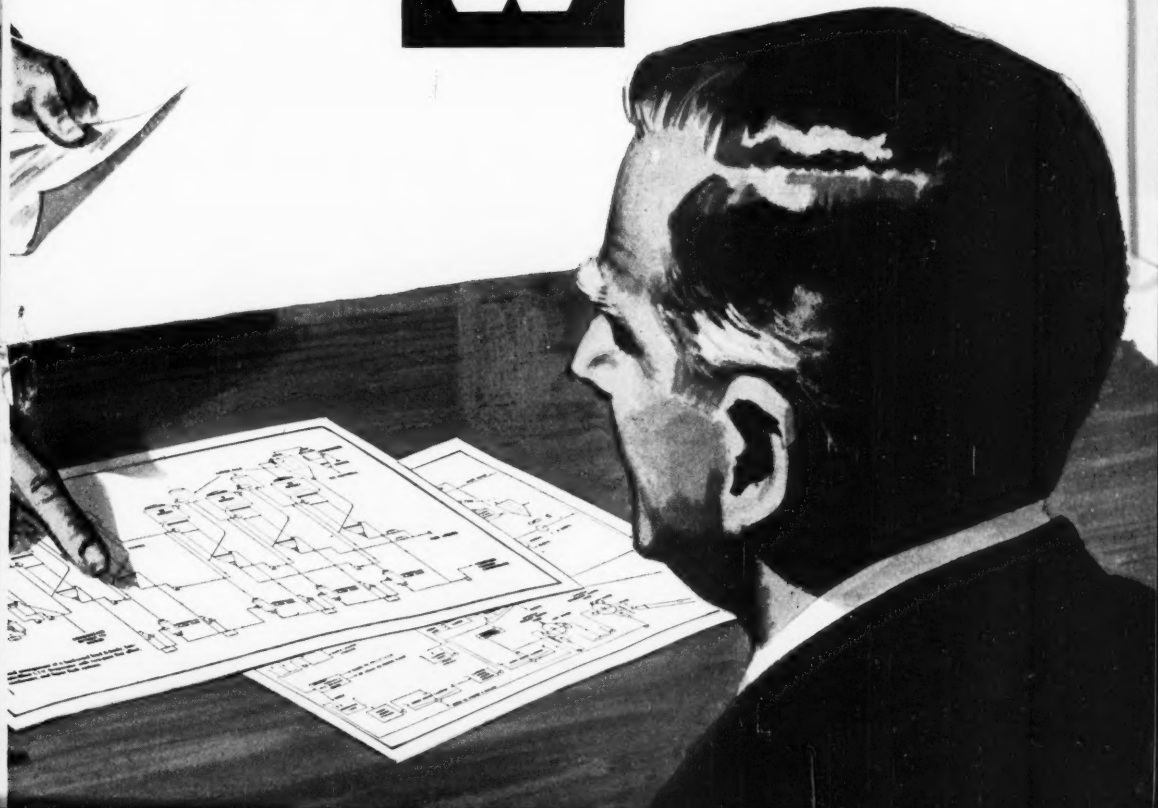
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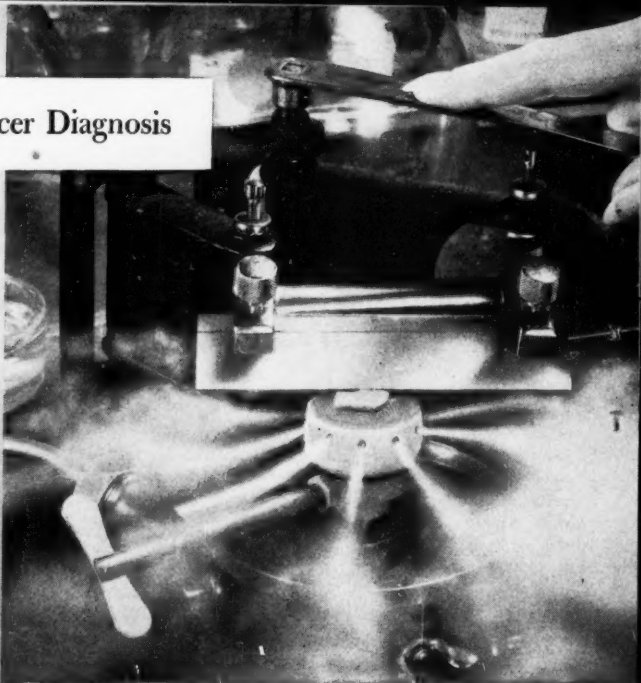


PROBLEM: Cancer Diagnosis

PROBLEM: To breathe clean air
in a foul room



ANSWER: Trapping dusts as small as 24 millionths of an inch in diameter is now possible by American Optical's revolutionary new respirator filter. This chemically treated filter has 40 times the efficiency of similar untreated filters, does work of filters 8 times as large, yet is no harder to breathe through.



ANSWER: Is it cancer or not? While the patient lies on the operating table, pathologists can look at a microscopic slice of human cell tissue and find out. First, the tissue is frozen by carbon dioxide gas, then is sliced by a *microtome* to an incredible thinness of 12 microns (.00048 inch). Once the finest microtomes came from Europe, American Optical has long since equaled and passed their precision.

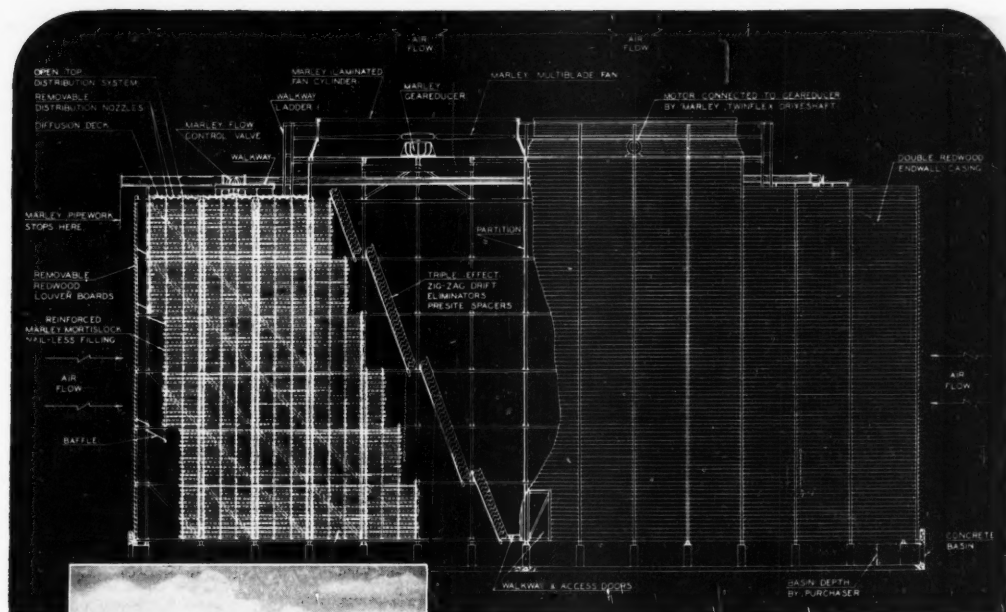
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ANSWER: Books and records, too valuable to lose, are now copied on tiny film, saving time, shelf space, money. American Optical's microfilm "reader" enlarges to natural size and clearly projects the microfilm. These flat, undistorted, projected images may be read comfortably for hours. Write us about your development problems. Address American Optical Company, 60 Vision Park, Southbridge, Mass.

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2. How to definitely cut maintenance ?
3. How to effectively prevent spoilage ?
4. How to insure a higher product quality ?

THIS ANSWER

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THESE REASONS!

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3. Trouble-free service.
4. Smooth operation.
5. Tight closure.
6. Speedier production results.
7. Elimination of failures.
8. Cost-saving operation.
9. No spoilage.
10. Practically zero in maintenance.



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LIKE THIS
*Eliminated***

WRITE FOR
BULLETIN
962

**YOU GET THIS
Streamlined
PATTERN**

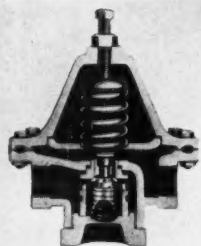


**CASH STANDARD
CONTROLS..
VALVES**

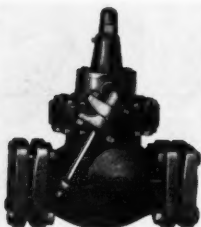
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**BULLETINS
AVAILABLE
ON OTHER
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VALVES**

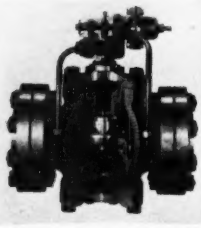
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

Whatever You Want To Filter

If your material is similar in characteristics to any of these, it can be filtered successfully and economically by a Bird Filter.

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Ammonium Alum
Ammonium Chloride
Ammonium Nitrate
Ammonium Sulphate
Aniline Sludge
Barium Carbonate
Barium Chloride
Barium Sulphate
Beryllium Sulphate
Black Ash
Borax
Calcium Carbonate
Carnallite
Chromium Oxide
Coal, bituminous &
anthracite
Copper Sulphate
Copperas

Cryolite
Di-Sodium Phosphate
Ethyl Cellulose
Fish Meal
Flotation Concentrates
Flotation Tails
Foundry Sands
Gland Extracts
Glaucous Salt
Glutamic Acid
Hexachlorethane
Hexamine
Iron Ore
Iron Oxide
Langbeinite
Lead Arsenate
Lead Chromate
Lime
Lime Mud

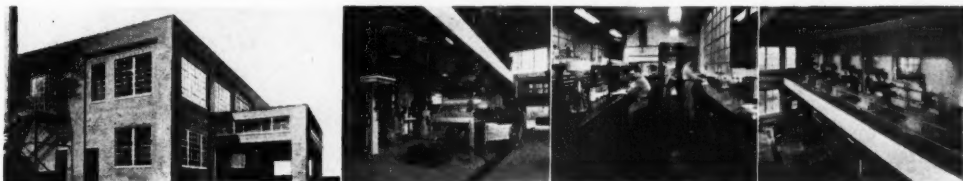
Lithopone
Manganese Ore
Nickel Salts
Packing House Waste
Phenol
Phosphate
(High Grade Residue)
Potassium Carbonate
Potassium Chloride
Potassium Hydroxide
Potassium Nitrate
Potassium Sulphate
Potato Starch
Sodium Bichromate
Sodium Carbonate
Sodium Chloride
Sodium Fluoride
Sodium Hydroxide
Sodium Nitrate

Sodium Stannate
Sodium Sulphate
Sodium Sulphite
Sodium Thiosulphate
Solvent Extractions
Starches
Sulfur
Synthetic Resins
Tallow
Tartaric Acid
Tin Ore
Titanium Dioxide
Tri-Sodium Phosphate
Tungsten Salts
Ultramarine Pigment
White Lead
Zinc Chromate
Zinc Oxide
Zinc Sulphide

Get The Filtration Facts First

The Bird Research and Development Center has the staff and the facilities to make pilot scale tests

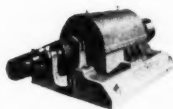
and give you performance facts and figures in advance of your equipment investment.



Then Get The One Best Filter For The Job

Bird builds all these types of solids — liquids separating equipment — will recommend only the

one that assures the best combination of filtering, washing, capacity and economy.



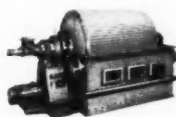
The BIRD
Continuous
Solid Bowl
Centrifugal Filter



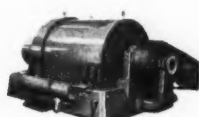
The BIRD
Screen
Centrifugal Filter



The BIRD
Suspended
Centrifugal



The BIRD-Young
Continuous
Vacuum Filter



The BIRD
Centrifugal
Classifier

BIRD MACHINE COMPANY
SOUTH WALPOLE • MASSACHUSETTS

most efficient

PETRO - CHEM ISO - FLOW FURNACES

by any comparison

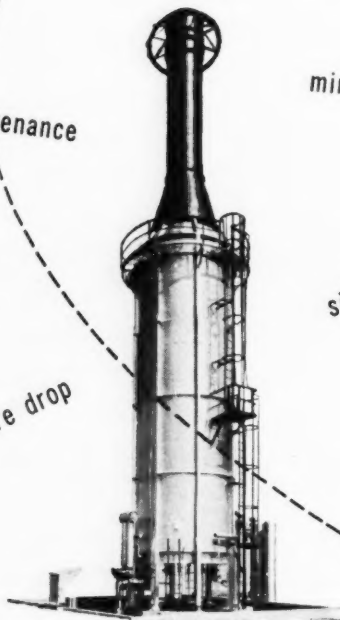
low maintenance

minimum ground space

simplicity of design and construction

low pressure drop

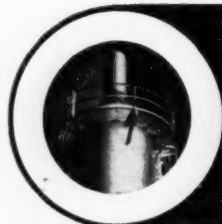
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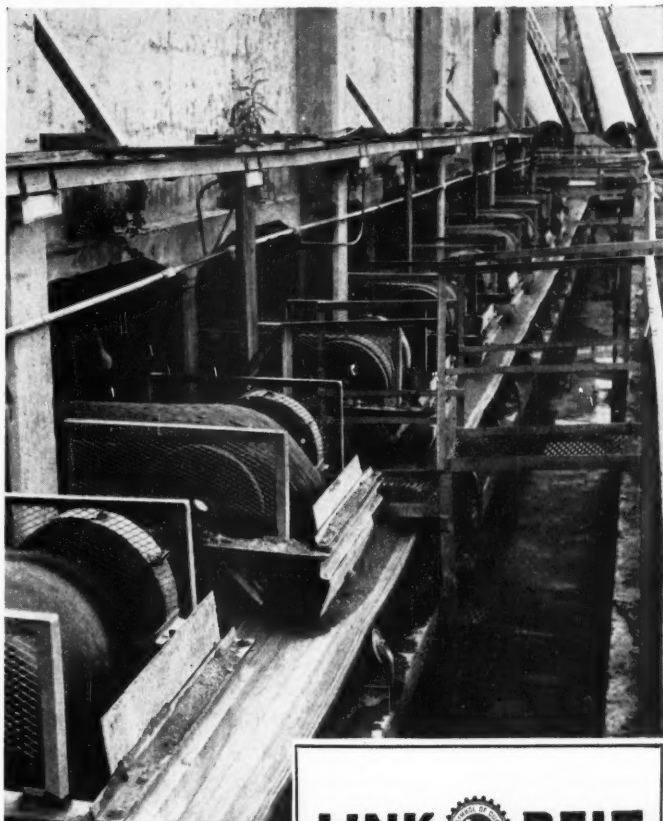
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Link-Belt will gladly work with your engineers or consultants. Get in touch with your nearest Link-Belt office.



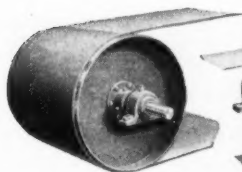
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities.

12,747-D

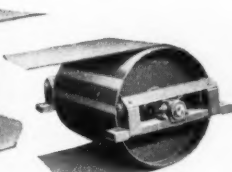
L-B collecting belt conveyor receives wet phosphate rock from 13 belt feeder-conveyors under storage bins. Eleven of feeder-conveyors are reversible.

LINK-BELT
BELT CONVEYOR EQUIPMENT

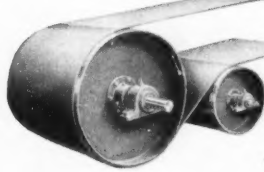
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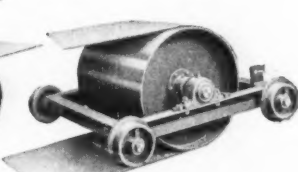
Terminal with single pulley drive



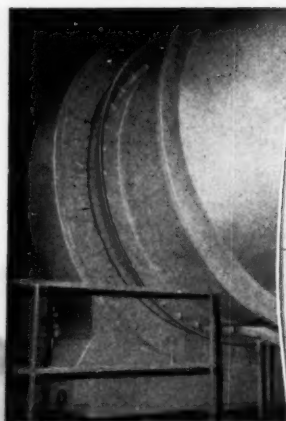
Terminal with screw take-up



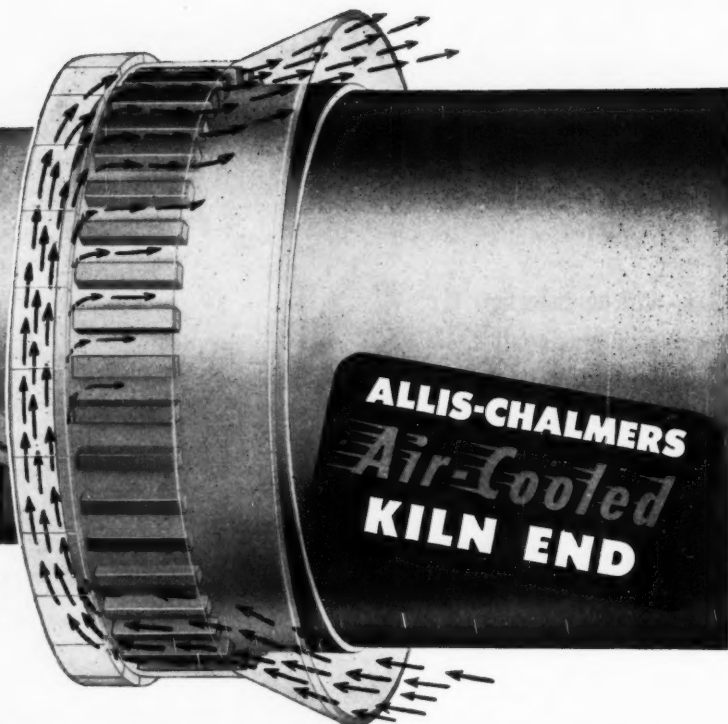
Terminal with snubbed pulley drive



Terminal with counterweighted take-up



Cooling air circulates around outside of kiln's discharge end, and on underside of nose castings, as shown. Rotary kilns now in operation can be modernized with installation of air-cooled end.



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Air-Cooled
KILN END

Pays for Itself in 2^{to} 3 Years

... IN REFRACTORY SAVINGS ALONE!

BIG REFRACTORY SAVINGS . . . Discharge end of kiln shell stays cool, round and rigid. Refractory brick at discharge end lasts longer because air-cooled discharge end eliminates warpage or end distortion.

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A-3566

Get more facts from the A-C representative in your area . . . or send for Rotary Kiln Bulletin 07B6368A. Allis-Chalmers, Milwaukee 1, Wisconsin.



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FIRST IN RUBBER



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Where B.F. Goodrich grommet belts outlasted others 3 to 1

B.F. Goodrich grommet V belts cut costs 20 to 50%

ORDINARY belts, previously used on this drive, couldn't stand the heavy load, couldn't take the strain of 24-hour-a-day service. There were frequent shutdowns for repairs. Belts were averaging only 3 months' life. Then B.F. Goodrich grommet V belts were installed. When the picture was taken, the grommet belts had already outlasted ordinary belts 3 to 1, maintenance costs had been cut nearly 100%, and the belts still looked good for a lot more service. Here's why:

No cord ends—A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength—All of the cord material in a B. F. Goodrich grommet belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. There are no layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced. And grommet V belts stretch less—only $\frac{1}{3}$ as much, on an average, as ordinary V belts.

Better grip, less slip—Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give $\frac{1}{3}$ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

They cost no more—Grommet V

belts cut costs because they last longer, increase production because machines keep running with fewer interruptions, reduce maintenance costs because they need less attention, yet they cost not one cent more. Available in C, D, and E sections. But remember, only B. F. Goodrich makes the grommet V belt (U. S. Patent No. 2,233,294), so to get all these savings, call in your local BFG distributor the next time you need V belts, or write *The B. F. Goodrich Company, Industrial & General Products Div., Akron, Ohio.* (Available in Canada)

Grommet V-Belts BY
B.F. Goodrich
FIRST IN RUBBER

PUT UP TO STAY UP!



*THAT GRID UNIT HEATER'S
BEEN UP 16 YEARS
AND IT STILL DOESN'T
NEED REPAIRS!*

That's the statement of a large eastern chemical plant. Their letter to us continues: "We have found that cast iron construction stands up very well against the corrosive fumes of HCl , Cl_2 , etc. . . . the unit heaters that have copper tubes give trouble due to corrosion in a few years . . . we consider GRID Unit Heaters satisfactory and would certainly recommend them for installation where corrosive acid fumes exist". Such service record occurs because GRID is completely different from other unit heaters — here's how:

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GRID construction uses no brazed, soldered, rolled or welded connections between condenser and headers. A specially designed threaded nipple assures a precision, leakproof fit.

GRID construction has all similar metals in contact with steam thus preventing electrolytic corrosion which eventually occurs in copper type unit heaters where steam passes from iron pipes into copper cores. (Write for booklet **CORROSION IN UNIT HEATERS**).

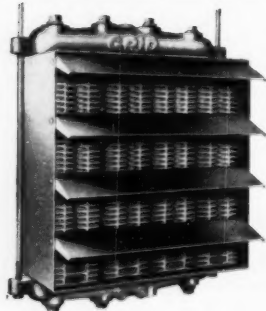
GRID construction resists corrosion from corrosive acid fumes that exist in chemical plants.

GRID design incorporating low outlet temperatures, proper fan sizes and motor speeds, assures delivery of warm comfortable air in ample volume to the working level. No stratification of warm air at the ceiling to waste your fuel dollars.

GRID BLAST COILS ARE IDEAL FOR MANY USES THROUGHOUT CHEMICAL PROCESSING INDUSTRIES — WRITE FOR CATALOG BC-1049.

These are the reasons why users of GRID Unit Heaters get 16 years and more of trouble-free service. There are units cheaper than GRID, but there are none better.

You start saving money the day you install GRID Unit Heaters.



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Youngsters learn best through their own experience.

A good way, but costly.

The experience of others can be as valuable. And more economical of time, materials and motions.

Certainly this is true of packaging. Do you use or contemplate using Multiwall bags? You will find it

worthwhile to draw upon the combined experience of Union's Multiwall packaging specialists. They have worked successfully with Multiwall users in hundreds of industries. Chances are they can help you.

More so every day . . .

IT'S UNION FOR MULTIWALLS





What does it cost to stop?

In many continuous processes so much depends on the unfailing operation of centrifugal compressors that the cost of a breakdown could be greater than the original cost of the compressor. That's why *dependability* in a compressor is your first concern.

Here are some things you should know before you buy any centrifugal compressor.

Who makes it? If it's a Carrier, it's made by people who've been making centrifugal compressors for thirty years now, people who've made some 2500 multi-stage centrifugals—more than anyone else.

How do they make it? If it's a Carrier, it's made by experienced craftsmen in the world's largest single plant devoted to the production of centrifugal compressors.

What's their application background? If it's a Carrier, it's made by the people who've handled more different gases than any other compressor manufacturer . . . the people who pioneered the use of centrifugals in many industrial processes.

In short, if it's a Carrier, it'll deliver the dependability you must have in a centrifugal compressor.

Our new catalog, "Centrifugal Compressors for Industry," will help you. Ask for it at the Carrier office nearest you, or write Carrier Corporation, Syracuse, New York.



Many of the men who built the first Carrier Centrifugal Compressor thirty years ago still build them.

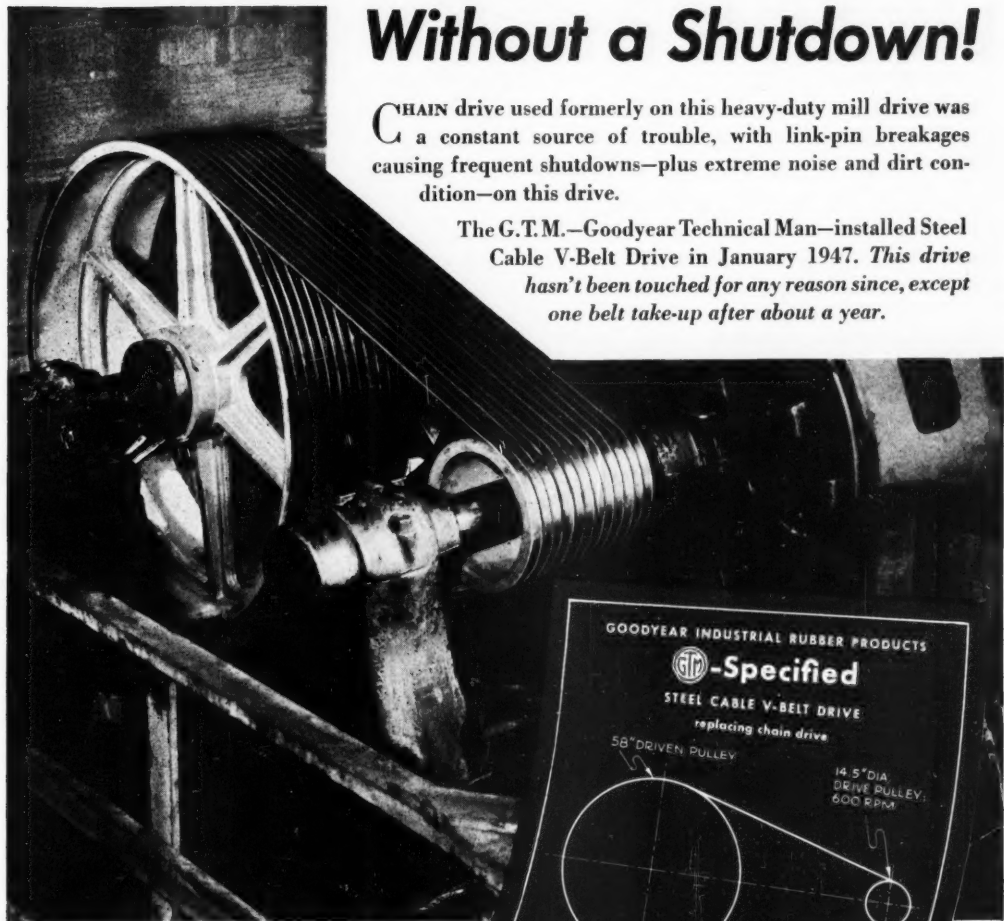
This leak test is one of many tough tests and inspections each Carrier Centrifugal Compressor must pass.

5 YEARS' SERVICE

Without a Shutdown!

CHAIN drive used formerly on this heavy-duty mill drive was a constant source of trouble, with link-pin breakages causing frequent shutdowns—plus extreme noise and dirt condition—on this drive.

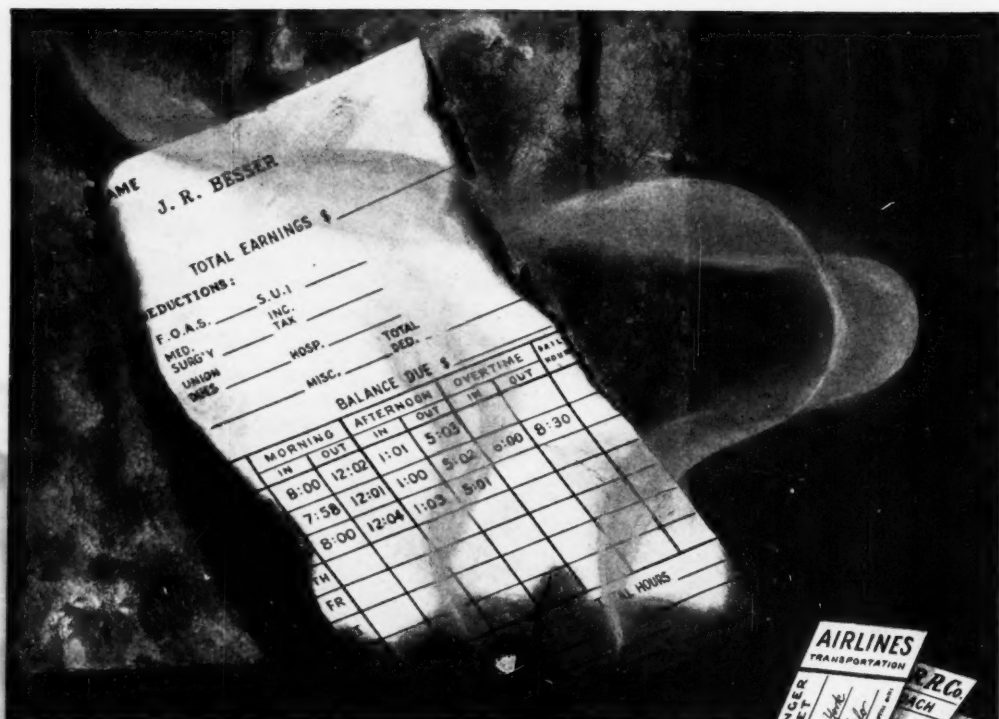
The G.T.M.—Goodyear Technical Man—installed Steel Cable V-Belt Drive in January 1947. This drive hasn't been touched for any reason since, except one belt take-up after about a year.



LOOK FOR YOUR GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods." He handles Hose, Flat Belts, V-Belts, Molded Goods, Packing, Tank Lining, Rubber-Covered Rolls, built to the world's highest standard of quality.

GOOD  YEAR

THE GREATEST NAME IN RUBBER



From time card to travel ticket

Every angle completely covered . . . but one! When fire strikes during the night your skilled labor may go in the morning. The fully experienced Joes, Bills and Toms can't stand the financial strain of waiting . . . their time cards can become travel tickets to new jobs, while you're struggling to replace the ravages of fire.

The threat of losing your skilled labor due to an unexpected fire tragedy can be fully eliminated. With C-O-TWO Smoke or Heat Fire Detecting Systems plus C-O-TWO High Pressure or Low Pressure Carbon Dioxide Type Fire Extinguishing Systems your plant can have fast, positive, round-the-clock fire watchman service simultaneously at each fire hazard point.

At locations where a deep-seated, smoldering internal fire as well as a fast burning external fire might occur, the smoke detector of a C-O-TWO Smoke Fire Detecting Sys-

tem, based on an exclusive operating principle, automatically detects the first trace of smoke, smoldering or fire.

For locations where excessive heat or combustion might cause a flash fire, the heat detectors of a C-O-TWO Heat Fire Detecting System automatically sound a warning at the first flash of fire.

Then clean, dry, non-conducting, non-damaging carbon dioxide is instantly released from either a C-O-TWO High Pressure or Low Pressure Carbon Dioxide Type Fire Extinguishing System into the threatened area. The fire is out in seconds with little if any interruption to operations and the carbon dioxide disappears without a trace . . . one of the safest fire extinguishing agents known . . . harmless to equipment, materials and finishes.

WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today . . . our extensive experience over the years is at your disposal without obligation. Get the facts now!



MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeeze-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

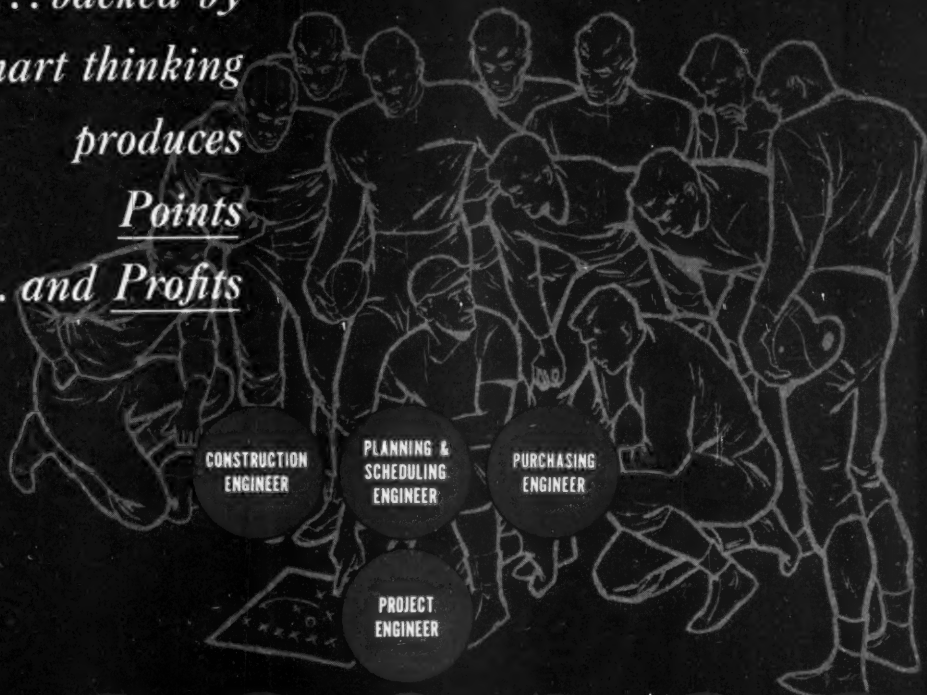
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Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

Blaw-Knox Teamwork

*... backed by
smart thinking
produces
Points
... and Profits*



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SCHEDULING
ENGINEER

PURCHASING
ENGINEER

PROJECT
ENGINEER

PROCESS
ENGINEER

MECHANICAL
ENGINEER

VESSELS
ENGINEER

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ENGINEER

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ENGINEER

Chemical Plants Division has a record for getting things done quickly and smoothly ... for starting from scratch with no more than the client's data, and terminating the contract with a complete operating plant.

Chemical and Processing plants of every type and size are within the scope of Blaw-Knox experience and abilities. A large organization of engineers, designers, technicians and their assistants forms a team ready to undertake with competence any job you may have in mind. Glad to discuss your tentative plans at your convenience.

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Chemical Plants Division

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ILLCO-WAY ionXchange



pioneers and leaders in ionXchange

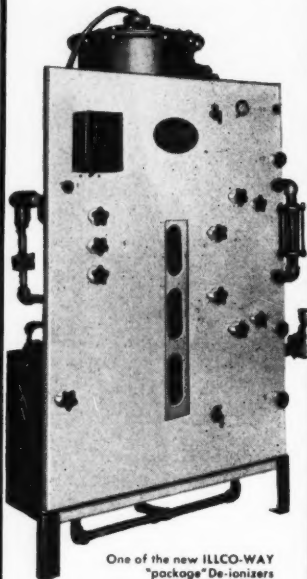
ILLCO-WAY "firsts" include manufacture of the first commercial two-bed De-ionizer . . . the first commercial mixed-bed De-ionizer . . . development and building of the first successful installation for beet-juice purification by ionXchange . . . and more recently the development of a similar process for the purification of crude glycerol. These and numerous other applications of ILLCO-WAY ionXchange technology are currently available for your products or processes.

ILLCO-WAY

**DE-IONIZING
DE-ALKALIZING
SOFTENING**

For complete data: see Sweet's File, Engineering; or Chemical Engineering Catalog

De-ionized Water in a "package"



One of the new ILLCO-WAY
"package" De-ionizers
(Mixed-Bed type)

A complete line of standard (package-type) De-ionizers—for production of solids-free De-ionized water used for solution make-up, rinsing, sealing rinse after anodizing (flow rates from 100 to 1000 gph.).

Units are compact, shipped completely assembled and base-mounted for ease of installation and operation, requiring only connection to raw water, drain and treated water outlets.

Three types: Mixed-Bed and standard two-bed, with or without silica removal. Ideal production units; convenient for laboratory and pilot-plant research.

Send for your free copy . . .

of Bulletin 853, containing general unit specifications, complete description of equipment and performance data. Please write on company letterhead. Address: Illinois Water Treatment Co., 844-10 Cedar St., Rockford, Illinois.



ionXchange

REINEVELD Centrifugals

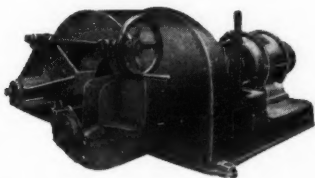
Meet Your Production
Needs with

LOWER PLANT INVESTMENT COSTS!



USE OUR TESTING AND LABORATORY FACILITIES

HEYL & PATTERSON is equipped with laboratory facilities and testing machines to examine your product. If you have a problem concerning centrifugals we will test your material and, on the basis of the results, recommend to you an economical and guaranteed application. This information will be given without obligation and will be held in confidence.



Reineveld Centrifuges, ranging in drum size from 36" to 79" drum diameter, can lower your plant investment costs in any of three ways:

- 1 When your operation requires a multiple-machine installation, the use of one large-size Reineveld Centrifuge can meet your production requirements *at a far less cost than several smaller machines.*
- 2 A Reineveld Centrifuge, in any frame size, will provide greater production at lower cost than any other machine of the same size because of its higher available centrifugal force.
- 3 Reineveld's smallest machine, the 36" Centrifuge, often costs less than other smaller centrifuges and, at the same time, gives far greater production potential.

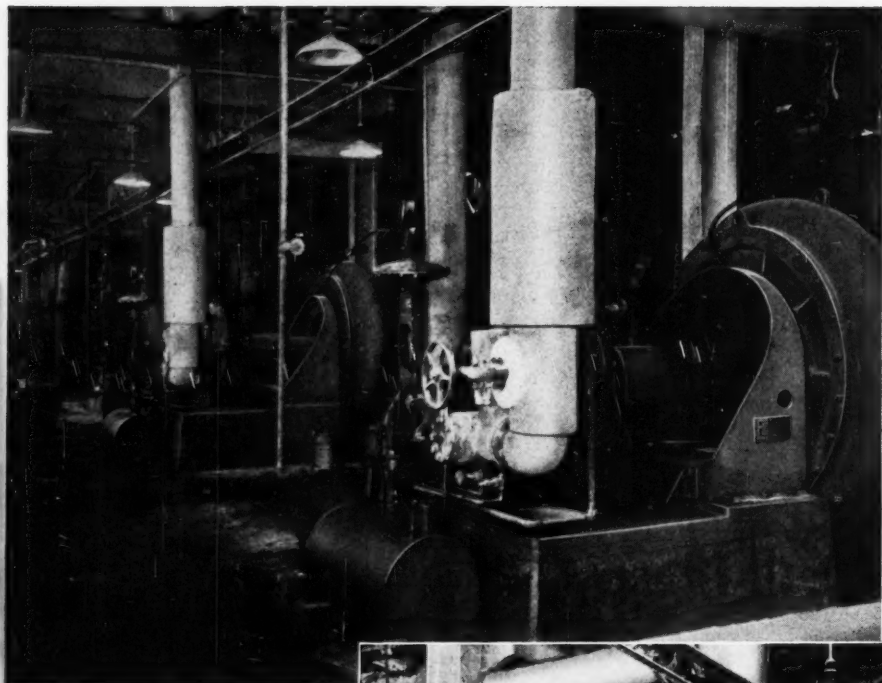
Write today for full information on Reineveld Centrifugals. Ask for Booklet 8-RC-2.

Heyl + Patterson, Inc.
"SINCE 1887"

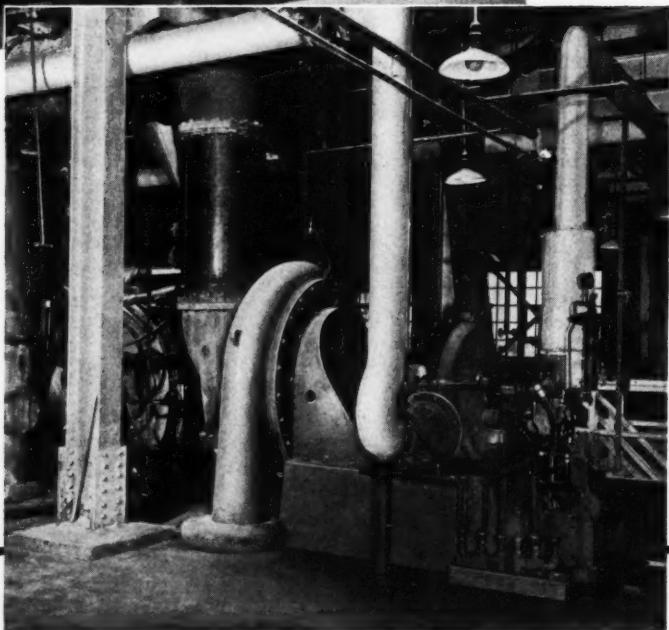
55 WATER STREET • PITTSBURGH 22, PA



Twenty years pulling



Part of the line of Elliott turbine-driven single-stage blowers serving continous filters at the Carlsbad plant.

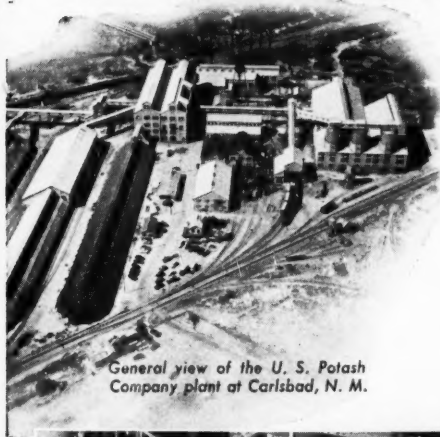


Another view of the blower line.
Discharge nozzles point down.

P2-2

brine-laden air!

ELLIOTT Centrifugal BLOWERS



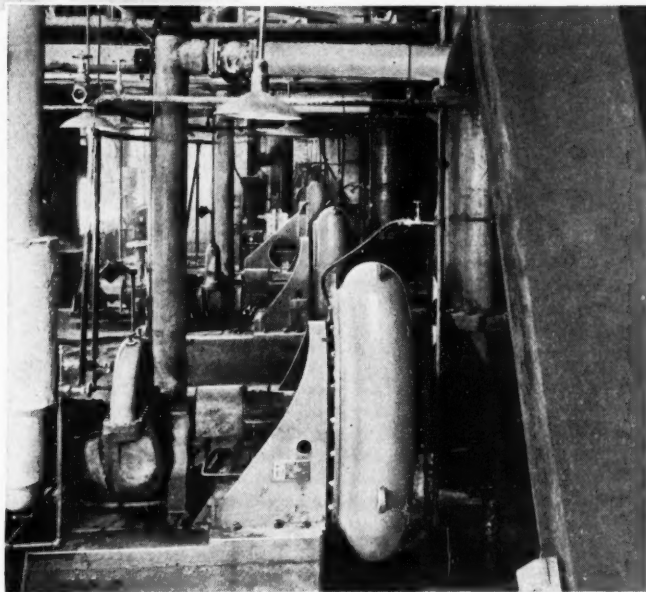
General view of the U. S. Potash Company plant at Carlsbad, N. M.

began serving the U. S. Potash Company of Carlsbad, New Mexico, in 1932, when the first of the present eleven Elliott turbine-driven blowers was installed.

Consider the type of service — round-the-clock operation, 363 days per year, handling air that is saturated with brine resulting from the hot solution leaching process used in separating potassium chloride from the sodium chloride and other impurities with which it is found. After crystallization of the potassium chloride in the solution, it is filtered, during which the Elliott blowers located at the suction end of the filters draw heated air through the filter drums. The possible corrosive action of the brine-laden air is minimized by impellers of special alloy.

It is significant that twenty years of this rigorous service, with only occasional outage for maintenance, has no terrors for Elliott blowers. The original unit is still going strong.

Elliott engineers will be glad to discuss your blower needs.



The line of eleven blowers used in potassium chloride separation. Each blower is rated 12,640 inlet cfm, with an inlet pressure of about 23.0 in. Hg, absolute, discharging to atmosphere (barometer 26.5 in. Hg) and is driven at 3670 rpm by an Elliott steam turbine developing 160 hp.

ELLIOTT Company

**Centrifugal Blower Dept.
Jeannette, Pa.**

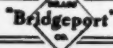
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BRIDGEPORT BRASS COMPANY

CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN



MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

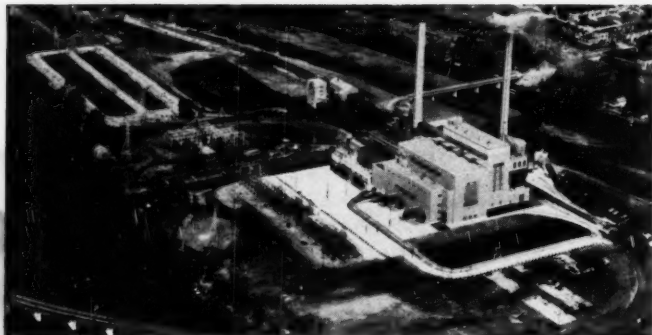


Figure 1. Barbadoes Island Station of Philadelphia Electric & Power Company.

Barbadoes Island Power Output Increased 275%

Generating enough power to supply the electrical needs of more than 500,000 families, the recently expanded Barbadoes Station of the Philadelphia Electric & Power Company is an outstanding example of a modern, efficient power plant.

Located on historic Barbadoes Island in the Schuylkill River between Norristown and Bridgeport, Pennsylvania, the station originally had a capacity of 48,000 KW. In 1949, two new turbo-generators were placed in service, each with an effective rating of 66,000 KW. The present capacity of the four operating units is 180,000 KW, which is used to supply the northwestern portion of Philadelphia Electric's territory.

Unit Arrangement for Reliable Performance

For the operation of the installations, a modified unit arrangement was adopted for simplicity and reliability. The turbo-generators, feedwater systems, main steam systems, draft and dust collector systems are kept separate, thus preventing any possible difficulty in one unit from affecting the operation of the other. The principal diversions from the unit arrangement are circulating water tunnels, cooling water system, stack and an auxiliary steam system.

Efficient Use of Bleed Steam

The heat balance diagram for one of the two identical units is shown in Figure 2. The economical use of bleed steam for producing feedwater temperatures suitable for the boiler design is apparent in this diagram.

Both main condensers are radial flow, two-pass, non-divided water-box type with 37,500 square feet of effective surface. Each condenses 375,000 pounds of steam per hour at 1 inch Hg. absolute pressure when supplied with 40,000 gpm cooling water at 50° F.

There are a total of 7,450 Admiralty tubes in the condenser. These tubes are 18BWG, 7/8 inch in diameter, with a wall thickness of .049 inches. The expected life of the tubes is from 15 to 20 years, based on the previous performance of other tubes of the same alloy with Schuylkill River water.

The air ejector for each unit is equipped with two banks of two-stage ejectors mounted on an inter and after condenser. They are designed for use with 400 psig motive steam to remove 8 cfm of free air and associated

water vapor at 70° F. The drain coolers are horizontal, two-pass units, each designed to heat 555,000 pounds of concentrate an hour.

All five feedwater heaters, in each system, are of the vertical, channel end up, four-pass, straight condensing type, designed to handle the same amount of concentrate per hour as the drain cooler. The operating water pressure through the tubes is 600 psig, although they are capable of handling 725 psig. The table in Figure 3 shows the number, dimensions and alloy of the tubes used in each of the heaters.

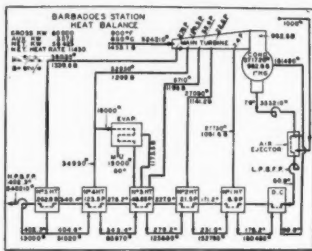


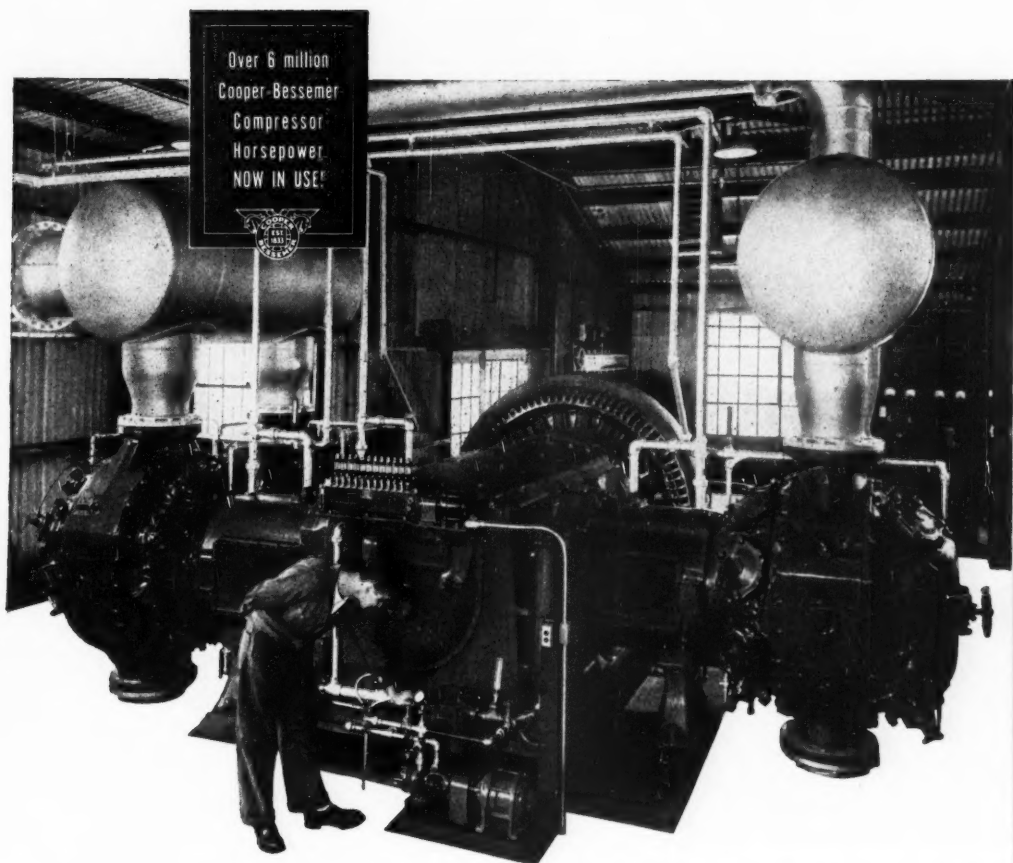
Figure 2. Heat balance diagram of one of the two identical units recently installed at Barbadoes Station.

Bridgeport Corrosion Laboratory

Changing operating conditions, new designs in equipment, and improvements in efficiency of power production call for alloys with special properties. Bridgeport's Corrosion Laboratory will be glad to work with designers, builders, and operators of power plants to help select the copper-base alloys which will give the most dependable service. Contact the nearest Bridgeport branch office for your condenser and heat exchanger tube requirements. (8759)

ITEM	NO. OF TUBES	SIZE (dia.)	GAGE	LENGTH	ALLOY
Drain Cooler	460	3/4"	16	216"	Admiralty
#1 Heater	798	3/4"	16	180"	Admiralty
#2 Heater	820	3/4"	16	162"	Admiralty
#3 Heater	820	3/4"	16	166"	Admiralty
#4 Heater	820	3/4"	16	174"	Admiralty
#5 Heater	820	3/4"	18	199"	70-30 Cupro-Nickel

Figure 3. Sizes and alloys of condenser tubing used in drain coolers and feedwater heaters.



FOR PFIZER ANTIBIOTICS . . . the "healthiest" of compressors

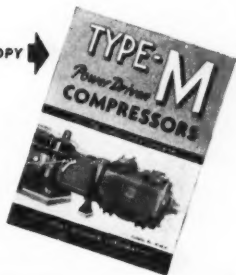
AT Chas. Pfizer & Co., Inc., Vigo plant in Terre Haute, antibiotic processing is a continuous operation, requiring lots of air. And since air failure would be disastrous, it was essential to have the most reliable compressor obtainable. The Cooper-Bessemer unit shown above was installed over a year ago: has been in virtually constant 24-hour-a-day operation ever since.

There's all kinds of proof that you can't top a Cooper-Bessemer compressor for reliability. What's more, its modern, compact design, with vibration-free opposed action, means smoothest operation, simplified maintenance, and substantial savings in space and foundation requirements.

Send for the latest bulletin, shown here, or check with the nearest Cooper-Bessemer office on the money-saving unit just right for your needs.

SEND FOR YOUR COPY →

Covers Cooper-Bessemer Type M compressors, 200 to 1000 hp. Other bulletins covering still larger size units are also yours for the asking.

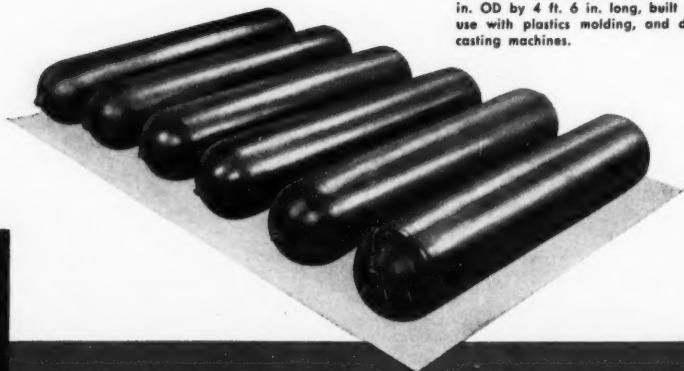


The
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Spun-end hydraulic accumulators, 14 in. OD by 4 ft. 6 in. long, built for use with plastics molding, and die-casting machines.



B&W

ACCUMULATORS

... 500 to 6,000 psi or higher—

5 gallons to 10,000 gallons

Now serving a broad variety of applications in the processing industries are several hundred B&W Accumulators for working pressures from 500 to as high as 6,000 psi and capacities up to 10,000 gallons. Installations include the three general types described below. Recent additions to B&W's fabricating facilities may permit extension of these pressures to considerably higher values. Every B&W Accumulator is designed and fabricated for utmost dependability and service life.

THREE GENERAL TYPES

SMALL ACCUMULATORS in capacities of 5 to 120 gallons for working pressures of 500 to 5,000 psi.

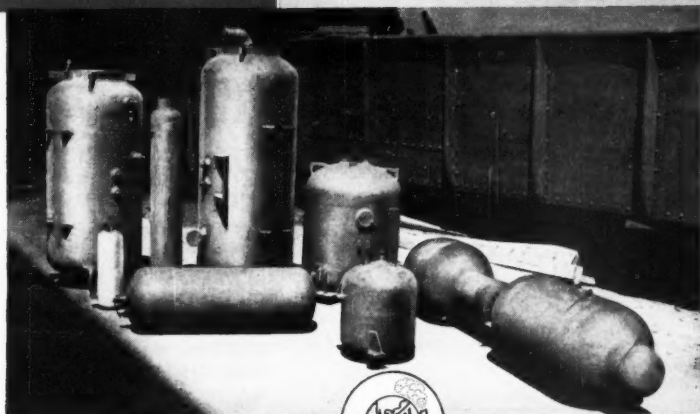
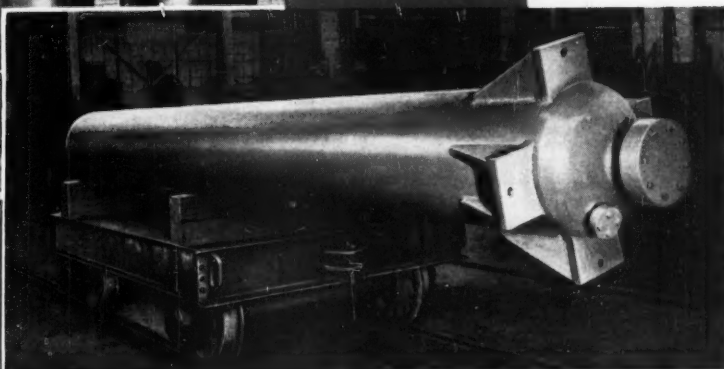
MEDIUM ACCUMULATORS of solid plate construction, in capacities of 120 to 10,000 gallons; working pressures up to 3,000 psi.

LARGE ACCUMULATORS of B&W banded construction, in capacities from 200 to 9,000 gallons for 2,000 psi and over.



Banded accumulators, 36 ft. high and 5 ft. O.D. for a hydro-pneumatic pressure system.

Solid plate accumulator, 22 in. dia. by 2-5/16 in. shell by 21 ft. 3 in. for 600 gallons with a working pressure of 3,000 psi.



Variety of small accumulators for 2,000 psi requirements on military equipment.



**BABCOCK
& WILCOX**

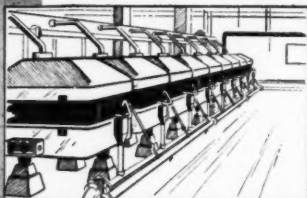
S-417

PROVED BY 33 INSTALLATIONS

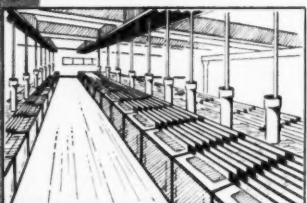
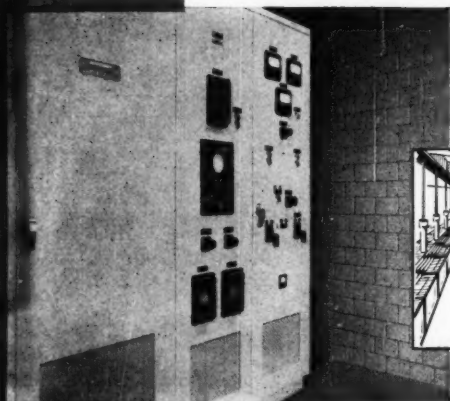


MECHANICAL RECTIFIER

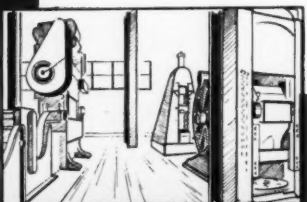
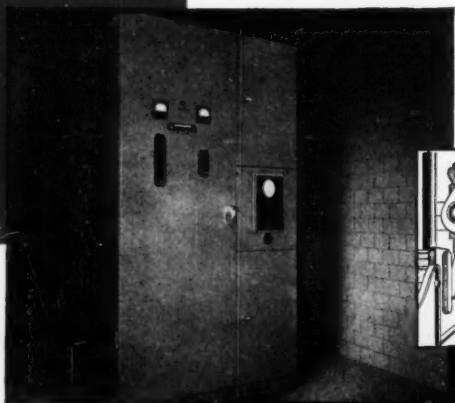
TYPICAL HEAVY-DUTY D-C APPLICATIONS



CHLORINE MANUFACTURE



METAL REFINING



MOTOR DRIVE

ALL THESE OUTSTANDING ADVANTAGES

- HIGH EFFICIENCY
- HIGH AVAILABILITY
- EASY OPERATION
- SMALL SPACE REQUIREMENT
- LOW BUILDING INVESTMENT
- LOW INSTALLATION COST
- RUGGED TRANSFORMERS
- EFFICIENT COMMUTATION
- SIMPLE VOLTAGE CONTROL

CAPACITY RANGE

Standard ratings for unit installations: 3000, 4000, 5000, 6000, 7000, 8000, 9000, and 10,000 amperes.

Additional capacity obtained by paralleling units of suitable ratings.

Output voltage: any voltage from 50 to 400 volts d-c.

Common primary voltages: 2300, 4160, and 13,800 volts—3-phase, 60 cycle, a-c.

gives highest efficiency...

96%—and higher—from a-c line to d-c bus

Take the most efficient *method* for converting a-c to d-c—by mechanical switching. Then design *equipment* to get the highest efficiency obtainable with this method. The result is almost ideal rectification.

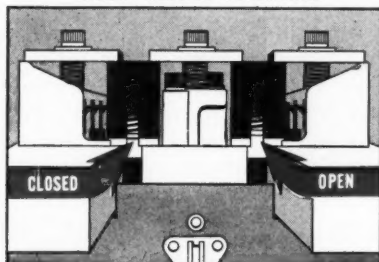
That's precisely what I-T-E engineers have done to bring you the most advanced, efficient, dependable means for converting a-c to d-c in the world today—the I-T-E Mechanical Rectifier.

The record of 33 outstanding installations to date—120,000 amperes of connected load—speaks for itself!

Here's why . . .

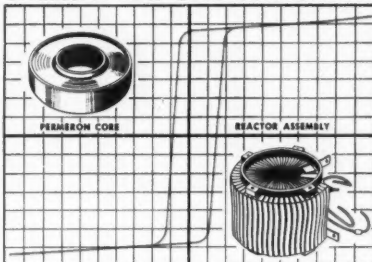
Here are the *two* fundamental reasons why these I-T-E Mechanical Rectifier users are getting 96 kw (and more) of direct current for every 100 kw of alternating current they buy:

SOLID SILVER CONTACTS



—held closed by powerful spring, give highest conductivity between a-c and d-c networks. 6 pairs of contacts make up basic contact system—one positive and one negative for each phase of 3-phase a-c supply.

SPARKLESS LOW-LOSS COMMUTATION



A Permeron® saturable-core reactor—between a-c supply and contact mechanism—provides a brief period during which current in a contact is zero! Time sufficient for sparkless contact opening is gained.

**I-T-E's special saturable core material. Typical Permeron magnetization curve is shown above.*

From a-c line to d-c bus, equipment is designed to hold all losses to a minimum. The I-T-E Mechanical Rectifier serves with 96% efficiency and higher—in the voltage range

between 50 v. and 400 v.—on continuous heavy-current processes. As a result, you can count on big savings—get more d-c from the power you buy.

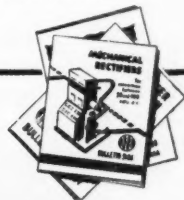
GET THE COMPLETE STORY—

Bulletin 5106—covers simple theory, space requirements, and standard arrangements.

Bulletin 5204—gives details of I-T-E's special magnetic core material, "Permeron."

Bulletin 5205—deals with engineering aspects of I-T-E Mechanical Rectifier efficiency.

Send for your copies, without obligation, today!

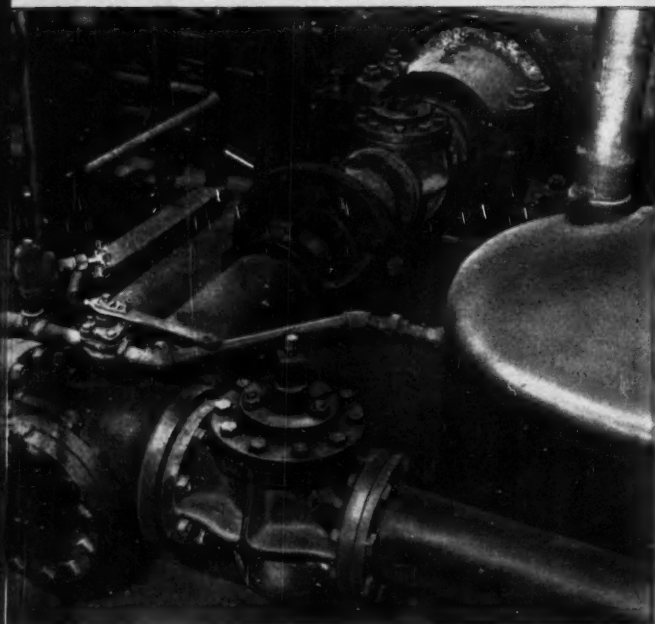


MECHANICAL RECTIFIERS

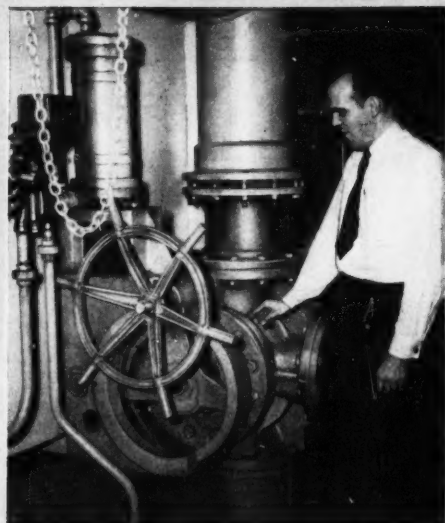
I-T-E CIRCUIT BREAKER COMPANY • RECTIFIER DIVISION • TWO E HAMILTON STS., PHILADELPHIA 30, PA.
 EPD Canadian Manufacturing and Sales: Eastern Power Devices, Ltd., Toronto

Specify Nordstrom Valves . . .

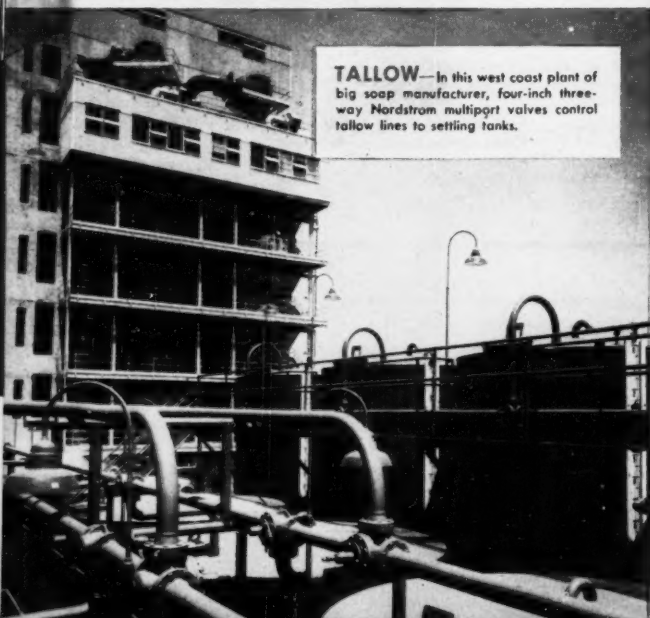
EXAMPLES . . . Vegetable Oils, Caustic Soda,



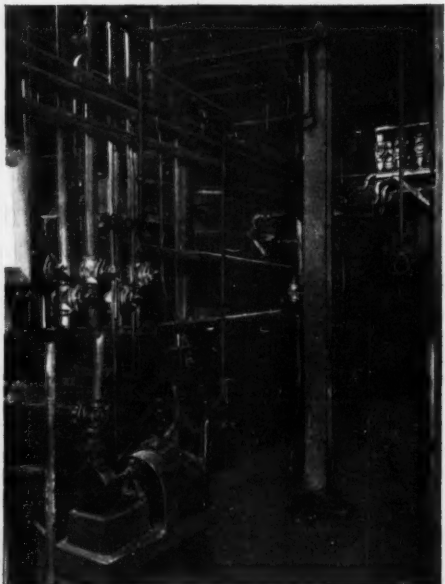
CARBON DIOXIDE—Cleveland paint maker installs Nordstroms on retort lines alternately handling carbon dioxide and vacuum. The six-inch Nordstrom at rear rotates with the tail pipe shaft.



COKE OVEN GAS—By-products plant in west has 12-inch gear operated Nordstrom valves on main line as safety shut-offs. Wide size range of Nordstroms makes standardization simple.



TALLOW—In this west coast plant of big soap manufacturer, four-inch three-way Nordstrom multiport valves control tallow lines to settling tanks.



VEGETABLE OILS—Crude oils from such nuts and seeds as sesame, copra, peanuts and soya beans are refined in California plant using Nordstrom valves on filter lines.

Keep Everything Under Control

Carbon Dioxide, Tallow, Lye, Coke Oven Gas

There are Nordstrom valves for hundreds of chemical applications. For instance:

- Three-way and four-way Nordstrom valves—in addition to the conventional straightway designs—are ideal for batching and blending lines.

- Special metals such as Type 316 Stainless steel, Nickel, Monel, Type No. 2 Ni-Resist, Nordco Bronze, Hastelloy B and Mercoloy are available to match the characteristics of nearly every normal chemical line fluid.

- A whole series of valve lubricants has been specially compounded for chemical service.

Chances are, whatever your process control problem, there's an easy-opening, positive-closing Nordstrom lubricant-sealed valve to solve it.

TYPICAL APPLICATIONS OF NORDSTROM VALVES IN THE PROCESS INDUSTRIES

Beverage Plants	Rubber Mills
Cement Plants	Sewage Plants
Chemical Plants	Smelters and Mines
Explosive Manufacturing	Soap Factories
Food Plants	Steel Mills
Gas Plants	Sugar Refineries
Gasoline Plants	Synthetic Ammonia Plants
Ice and Refrigeration	Synthetic Fibre Plants
Paint and Lacquer Mills	Synthetic Plastic Plants
Paper and Pulp Mills	Synthetic Rubber Plants
Petroleum Refineries	Tanneries
Pharmaceutical Plants	Textile and Dye Plants
Power and Steam Plants	Water Works

The new Nordstrom Corrosion-Resistant Valve Bulletin No. V-217 will make it easy for you to fit the right valve to each service. Rockwell Manufacturing Company, 400 North Lexington Avenue, Pittsburgh 8, Pennsylvania.

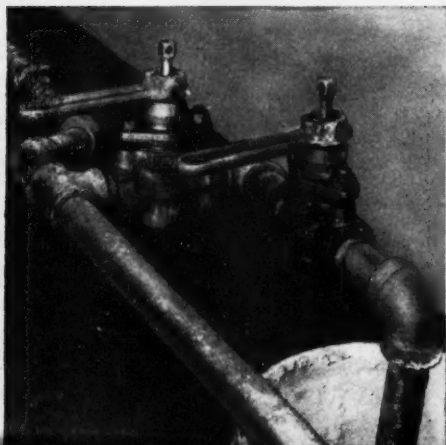


Write Today for Free Process Industries Bulletin, V-217

Rockwell Built
 Another  Product **Nordstrom Valves**

LUBRICANT SEALED TO KEEP UPKEEP DOWN

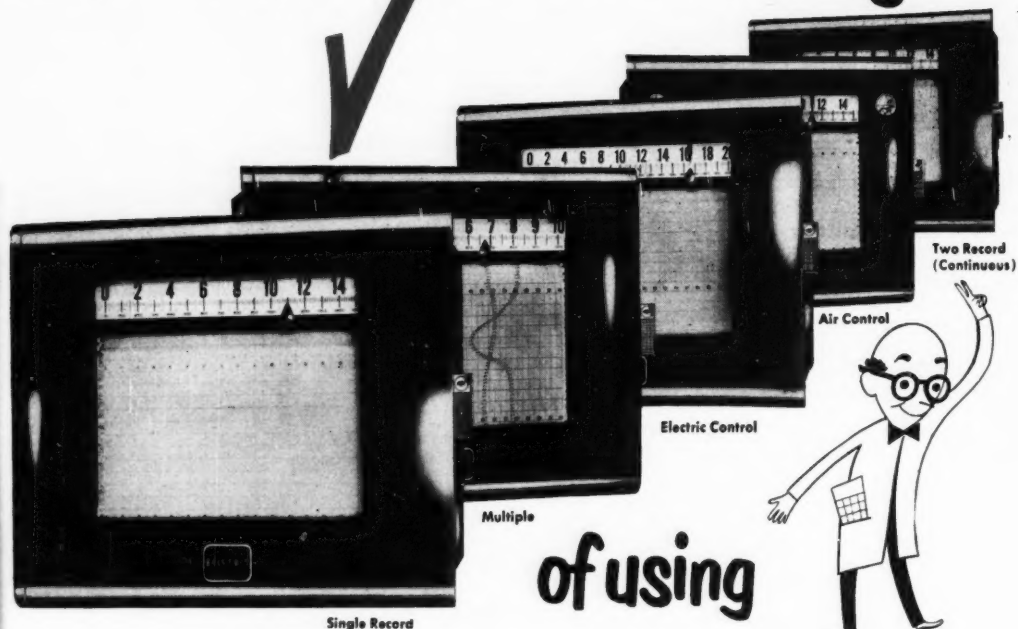
CAUSTIC SODA—In Long Island plant, Nordstroms regulate caustic soda and caustic potash in manufacture of sanitary chemicals and deodorizers. Wrench shows open or closed position of Nordstrom valves at a glance.



LYE—Storage transfer lines handling lye are regulated through intricate flow pattern by Nordstrom multiport valves. Batching and blending processes are simplified with multiports.



CHECK the Advantages



of using the Dynamaster Family

of continuous-balance electronic instruments

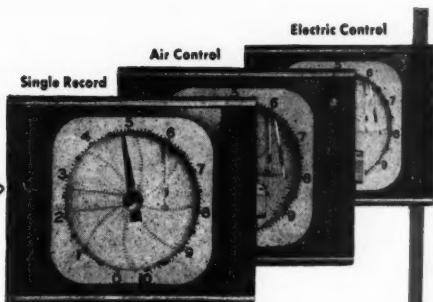
Strip chart or circular chart recorders . . . recorders with slow or fast pen speeds and chart speeds . . . single or multiple recorders . . . automatic controllers . . . all in the same case with identical components except the chart-drive mechanisms.

This variety-with-standardization assures you of easier installation, better looking control panels, simpler maintenance. The service man who knows one Dynamaster, knows them all.

BRISTOL

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



"Everyone who sees these Dynamasters is impressed with clean simplicity of internal design."

You'll be impressed too

WITH FEATURES LIKE THESE:

Models to measure any variable convertible into d-c voltage, d-c current, resistance, capacitance

Continuous-balancing electronic circuit assures instant response

All types of electric and air-operated controllers offered

Little or no maintenance

All models use the same easy-to-replace components

Electronic unit uses vacuum tubes available at any radio supply house

Full-scale pen travel of 7, 3 or $\frac{3}{4}$ seconds

Chart speeds from $\frac{1}{4}$ in. per hour to 7200 in. per hour.

Multiple recorders up to 16 points

Practically immune to vibration, shock, or external stray currents

YOU'LL WANT TO GET full details by using the coupon to order Catalog No. P1245.

COMPANIES LIKE THESE are using **Dynamasters**

North American Cyanamid Limited
Jones & Laughlin Steel Corporation
Raybestos-Manhattan, Inc.
Manhattan Rubber Division
Consolidated Edison Co. of New York, Inc.
Friez Instrument Division,
Bendix Aviation Corp.
Scovill Manufacturing Company
Pratt & Whitney Division,
Niles-Bement-Pond Co.
International Harvester Company
Westinghouse Electric Corporation
The Johns Hopkins University
United Aircraft Corporation
The Sponge Rubber Products Company
Commercial Solvents Corporation
Armstrong Cork Company
United States Steel Company
Collins Radio Company
Baldwin-Lima-Hamilton Corp.
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E. I. du Pont de Nemours & Co., Inc.
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Jarrell-Ash Company
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BEFORE BUYING CHECK BRISTOL!

BRISTOL	Maker "A"	Maker "B"
<input checked="" type="checkbox"/> accurate	<input checked="" type="checkbox"/> accurate	<input checked="" type="checkbox"/> accurate
<input checked="" type="checkbox"/> reliable	<input checked="" type="checkbox"/> reliable	<input checked="" type="checkbox"/> reliable
<input checked="" type="checkbox"/> easy to use	<input checked="" type="checkbox"/> easy to use	<input checked="" type="checkbox"/> easy to use
<input checked="" type="checkbox"/> low cost	<input checked="" type="checkbox"/> low cost	<input checked="" type="checkbox"/> low cost
<input checked="" type="checkbox"/> long life	<input checked="" type="checkbox"/> long life	<input checked="" type="checkbox"/> long life
<input checked="" type="checkbox"/> simple	<input checked="" type="checkbox"/> simple	<input checked="" type="checkbox"/> simple

THE BRISTOL COMPANY
109 Bristol Road
Waterbury 20, Conn.

Please send catalog giving details of Dynamaster performance to:

NAME _____ TITLE _____

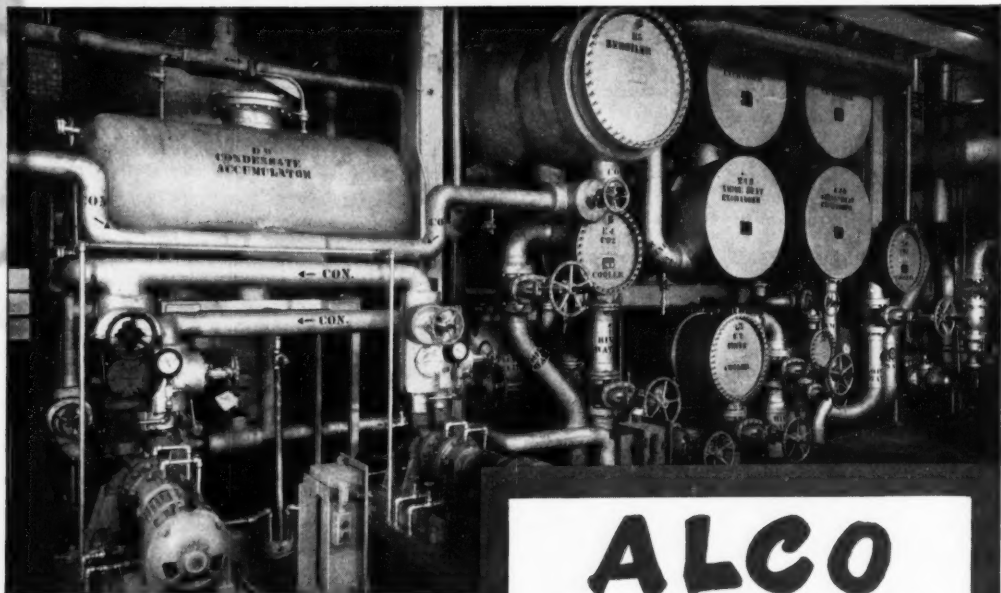
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



For details, contact your nearest ALCO Sales Engineer at Beaumont, Chicago, Dunkirk, Houston, Los Angeles, New York or Tulsa.



ALCO
ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Dunkirk, N. Y.

DU PONT quality is protected

-in drums equipped with
Tri-Sure
Closures



MILLIONS of automotive cooling systems are safe from costly freeze-ups—because they are protected by Du Pont's famous anti-freeze, "Zerone".

And "Zerone" quality is *safe* from contamination—safe from leakage and tampering in transit—because Du Pont uses drums equipped with Tri-Sure* Closures.

When a product must meet *exacting* requirements, the need for exacting safeguards is all the greater. And to experienced shippers this means the Tri-Sure *Flange, Plug and Seal*.

Take the risk out of your drum shipments, by taking the precaution that always pays: when you order drums, specify "Tri-Sure Closures".



Tri-Sure
Reg. U. S. Pat. Off.
CLOSURES

*The "Tri-Sure" Trademark is a mark of reliability backed by 30 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.

AMERICAN FLANGE & MANUFACTURING CO. INC.
30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.
Tri-Sure Products Limited, St. Catharines, Ontario, Canada

only through Engineering...
...can efficiency be achieved

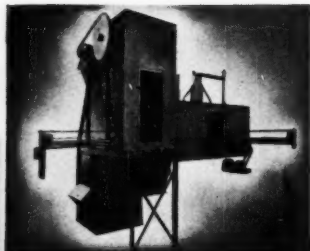
G-W

DRUM HANDLING SYSTEM

FULLY AUTOMATIC

TOTALLY ENCLOSED

DUST TIGHT

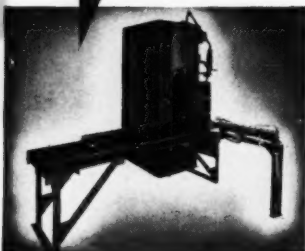


DRUM IN DISCHARGE POSITION

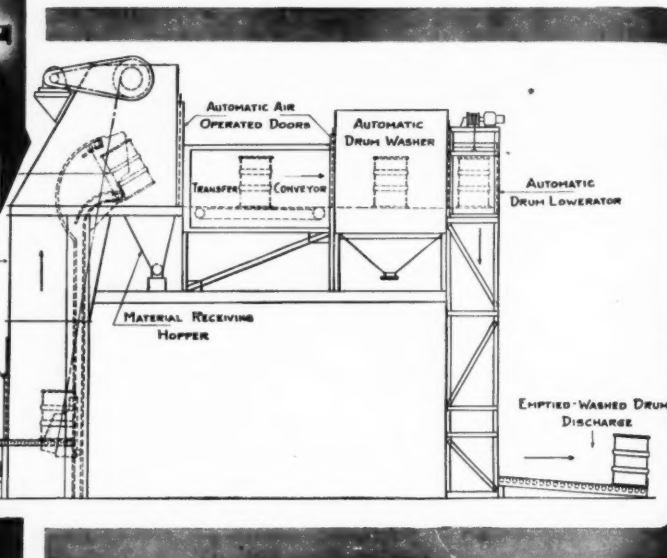
TOTALLY ENCLOSED
AUTOMATIC SKIP HOIST

AUTOMATIC AIR
OPERATED DOOR

FULL DRUM
FEED CONVEYOR



Call upon G-W Materials-Handling Engineers to survey your present methods; you are under no obligation. It might well prove to be a step toward higher profits through lower operating and maintenance costs.



Faced with an ever-increasing bottleneck in drum handling, a large eastern manufacturer placed his problem in the hands of Gifford-Wood's Materials-Handling Engineers. The result was the fully automatic system shown in the drawing. This dust-tight, fully enclosed installation now handles drums at the rate of 30 to 40 drums per hour.

The cover of the full drum is removed at a point on the feed conveyor. The full drum is then elevated and inverted, pouring the contents

over a vibrating grate into the receiving hopper. Carried on a transfer conveyor to the automatic washer, the drum is cleaned, then lowered to the discharge conveyor.

This is just one of many examples of how G-W materials handling know-how achieved efficiency through engineering — efficiency in this case reflected in automatic handling at a greatly increased rate, with elimination of waste and maximum safety — all at greatly reduced cost.

When You Think of Materials Handling—Think of **GIFFORD-WOOD Co.**

Since 1814 • Hudson, New York

NEW YORK 17, N. Y.
420 LEXINGTON AVE.

ST. LOUIS 1, MO.
RAILWAY EXCHANGE BLDG.

CHICAGO 6, ILL.
365 W. WASHINGTON ST.

LADISH

Controlled Quality

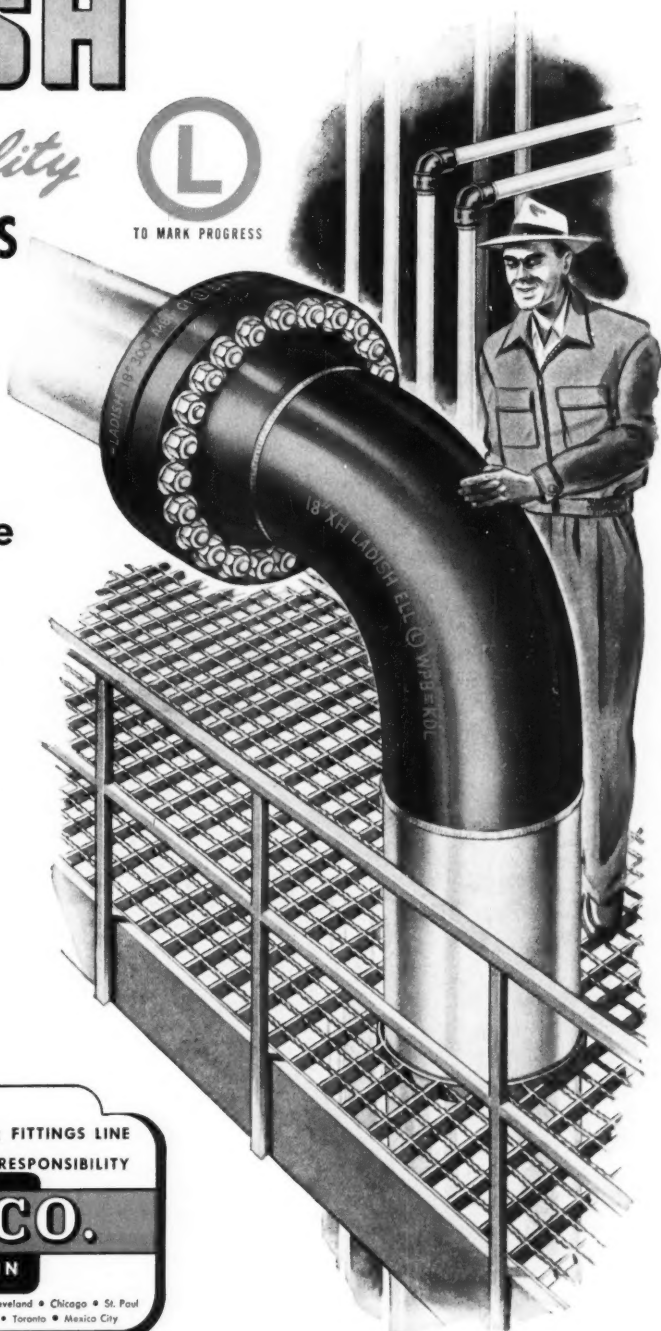
PIPE FITTINGS



TO MARK PROGRESS

metallurgically
sound for
maximum service

Sound metallurgy... the result of unsurpassed facilities and advanced laboratory controls... provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality... composition, structure and physical properties... is continuously safeguarded—and certified proof of metallurgical integrity is available to users of Ladish fittings.



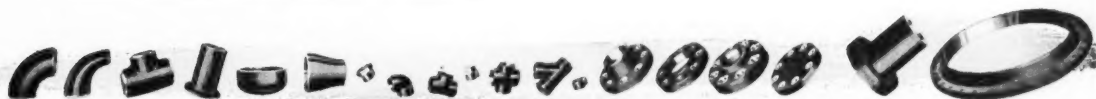
THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

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District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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**TYPICAL MATERIALS
HANDLED BY
FULLER-KINYON
CONVEYING SYSTEM**

Asphalt filler dust
Barytes
Bauxite
Catalysts
Cement (Portland)
Cement raw Materials
Chalk
Clays (dried)
Coal (pulverized)
Coke Dust
Dolomite (pulverized)
Feldspar
Flue Dust
Fly Ash
Fuller's Earth
Gypsum (calcined)
Gypsum (raw)
Lime
Limestone (pulverized)
Magnesite
Manganese dioxide
Ores (pulverized)
Phosphate rock (pulverized)
Rock dust
Soda ash
Starch

Check and PASS ON

Make this a memorandum — and Pass On to others — if your processes require mass handling of dry, pulverized materials.

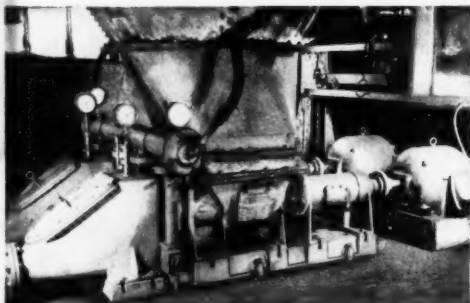
Check the materials which you handle and Pass On this information to the Fuller Company.

With twenty-six years of experience in this specific field, the Fuller Company can help engineer your handling methods into less costly, more efficient, more dependable operation.

THE FULLER-KINYON SYSTEM FOR DRY PULVERIZED MATERIALS CONVEYING HAS SEVERAL DISTINCT BENEFITS:

1. Mechanical movement limited to few parts.
2. Little to get out of order.
3. No explosion or occupational hazards.
4. Pipelines carry material vertically, horizontally, around corners — between multiple operations.
5. Fuller-Kinyon Pumps maintain full capacity over long travel distances, at low cost.
6. Portable units perform several operations.

Pass on the word to Fuller for specialized engineering assistance on any problem involving mass handling of dry, pulverized materials. Fuller's twenty-six years of such experience is yours to command. Send along a memorandum to Fuller now.



Quick, dust-free handling of pulverized coal, using Fuller-Kinyon System.

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS •
COMPRESSORS AND VACUUM PUMPS •
FEEDERS AND ASSOCIATED EQUIPMENT

Fuller

FULLER COMPANY, Catasauque, Pa.
120 So. LaSalle St.—Chicago 3
420 Chancery Bldg.—San Francisco 4

P-146
1631

NEW VARIATIONS ON AN OLD THEME*

Recording new and old variations on the uses of its products

is a fundamental part of Niagara's service to industry.

NIALK® Caustic Potash

Because of their high degree of purity, NIALK Caustic Potash and NIALK Carbonate of Potash are used effectively in extremely sensitive photographic baths where all chemical performance must meet the highest standards of quality and uniformity.

Due to forward-looking research and precise production methods, NIALK products rank with the best in the field of electrochemicals.

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York

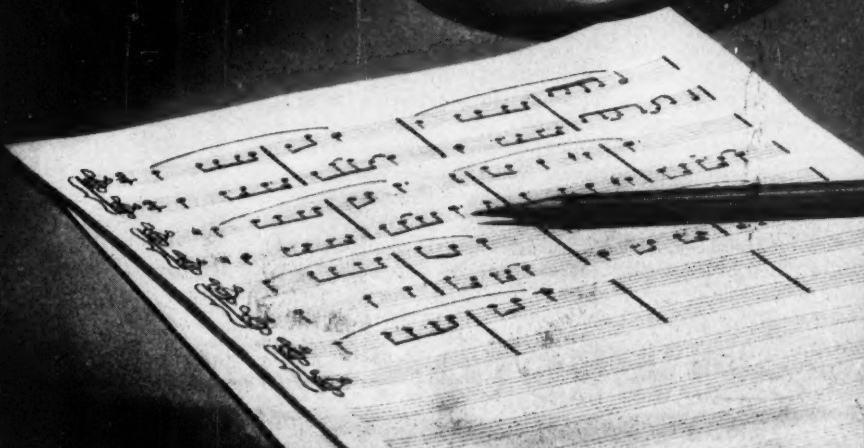


NIALK LIQUID CHLORINE NIALK CAUSTIC POTASH

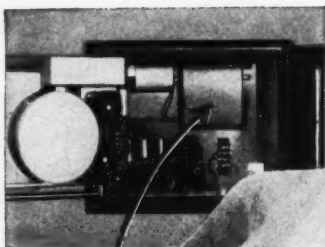
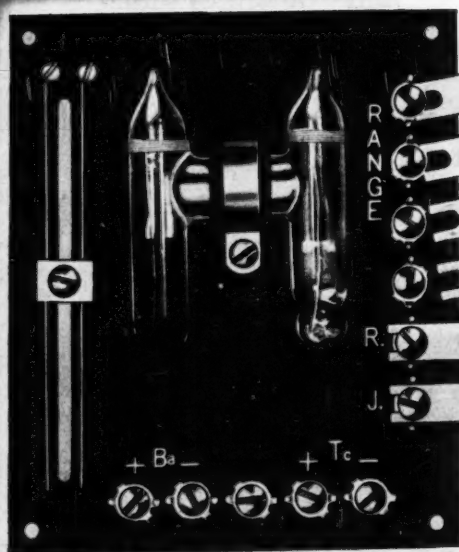
NIALK CARBONATE OF POTASH NIALK PARADICHLOROBENZENE

NIALK CAUSTIC SODA NIALK TRICHLOROethylene

NIAGATHAL (TETRACHLORO PHTHALIC ANHYDRIDE)



You change ranges
this simple way



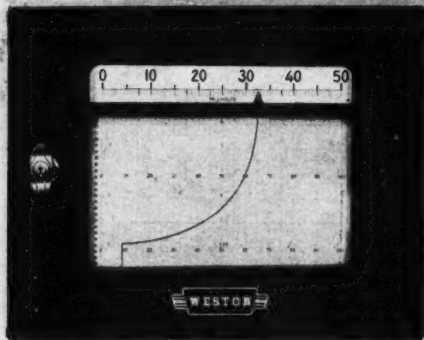
New!
simplified...

Recording Potentiometer by WESTON

The question probably occurs to you, as it has to many other instrument users who have examined the new WESTON Recording Potentiometer, "Why haven't such improvements been offered before?"

Take range changing, just as an example. You make the change, simply by inserting the desired range standard, as illustrated above. Not even a soldered connection to break. No change in the universal slide-wire necessary. And reference junction compensation is changed in like manner, when changing type of sensing element.

And there are many more features, electrical and mechanical, that remove the complexities from instrument operations and maintenance. They're all found in this new WESTON Recorder. Ask us to send you all the facts... WESTON Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey... *manufacturers of Weston and Tag Instruments.*



WESTON *Instruments*

... INDICATE - RECORD - CONTROL

"Buffalo"

Tips on Better Pumping

PROPER INSTALLATION

—A "MUST" FOR BEST RESULTS

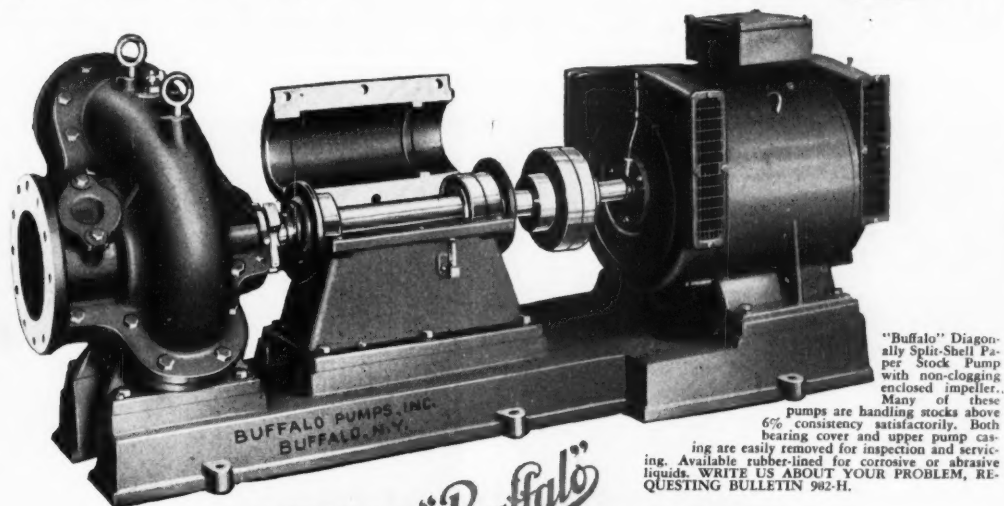
1. *Locate pump as close as possible to water supply* to keep suction line short and direct. Give your pump the best chance for peak performance.
2. *Keep friction losses at a minimum* by keeping fittings to a minimum and suction pipe larger than the suction opening of the pump.
3. *Avoid air locking in suction line.* Be sure suction line has no "humps" or "hollows" where air pockets might form.
4. *Maintain shaft alignment.* Pump foundation should be sturdy enough to avoid sagging, which causes misalignment. When installing pump, check alignment with feeler gauge between impeller and clearance ring to be sure clearance is the same at all points. Poor alignment results in excessive coupling and bearing wear, and lowered efficiency.

Be Sure The Pump Is Right, Too

Since the installation can be no better than the pump, it is important to pick one of known quality. "Buffalo" Pumps are giving satisfaction in every industry, handling every type of liquid from clear water to paper stocks. They are known for their high efficiency, their simple maintenance, their long life on the job. Specify "Buffalo" and be sure of the results you want. Below is one of many types of dependable "Buffalo" Pumps.

Specify

"Buffalo"



"Buffalo" Diagonally Split-Shell Paper Stock Pump with non-clogging enclosed impeller. Many of these pumps are handling stocks above 6% consistency satisfactorily. Both bearing cover and upper pump casing are easily removed for inspection and servicing. Available rubber-lined for corrosive or abrasive liquids. WRITE US ABOUT YOUR PROBLEM, REQUESTING BULLETIN 982-H.

BUFFALO PUMPS, INC.

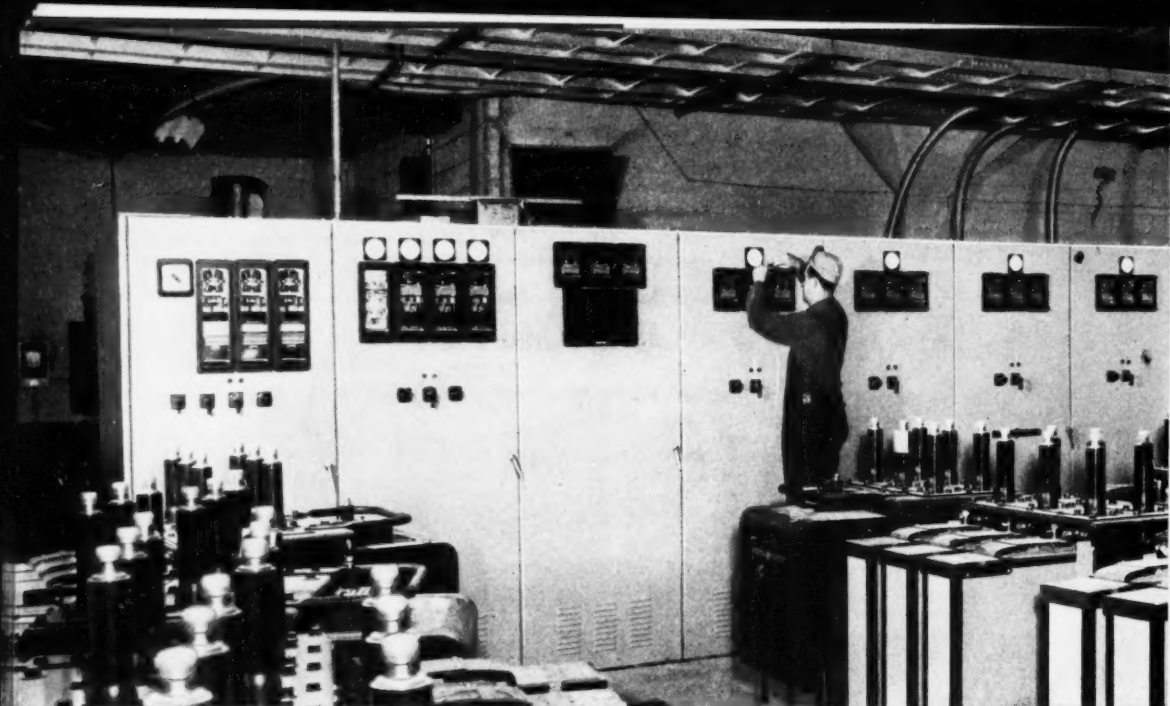
501 BROADWAY

BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

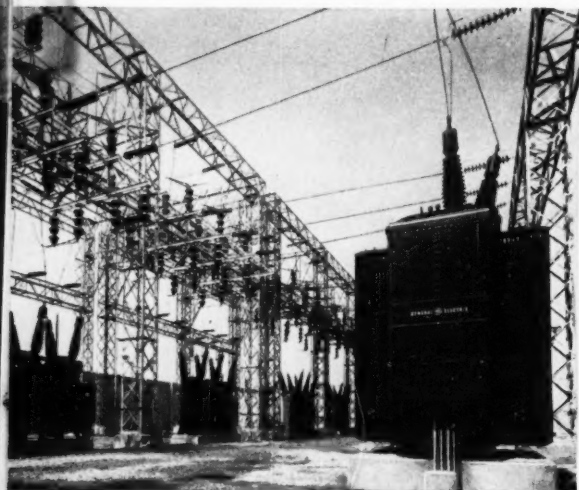
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



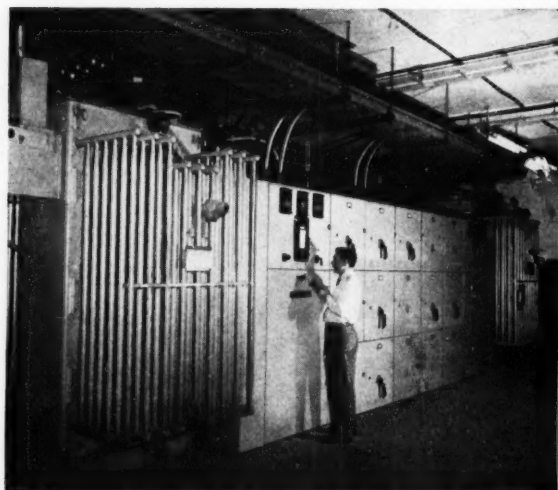
IMPROVED G-E METAL-CLAD SWITCHGEAR shown being installed above, has many new features that provide for increased safety and protection against power shut-downs. Units in the fore-

ground are removable 13.8-kv G-E magne-blast circuit breakers, ready to be moved into all-steel switchgear compartments. Switchgear unit was supplied fully assembled, ready to connect.

How General Electric Switchgear Helped



OUTDOOR SUBSTATION, built entirely from standard units, including transformer, oil circuit breakers and complete steel structure. Standard units saved months in planning and installation.



LOAD-CENTER UNIT SUBSTATION, one of 18 installed in plant, supplies low voltage power close to machines—eliminates voltage drop encountered with long, low-voltage feeder systems.



SHADOW-PROOF INSTRUMENTS with new, easier to read, long scales, are typical of many advances featured in improved G-E Metal-clad Switchgear. Instruments enable constant check to be kept on many circuits feeding power throughout plant.



REMOVABLE MAGNE-BLAST CIRCUIT BREAKER, offers maximum accessibility for testing and inspection—may be easily replaced with a spare if necessary. Adequate interrupting capacity gives full protection against electrical failures.

Speed Major Production Change-over

**Standard equipment helps solve difficult conversion problem
—gets defense plant in production 3 months ahead of schedule**

When one of the nation's biggest manufacturers planned to convert a 53 acre light duty assembly plant into the country's largest tank arsenal, electric power requirements posed a major problem. To handle the tremendous demands of such a heavy industrial operation, a completely new power distribution system was needed. It had to be dependable, with maximum protection against power shut-downs. And it had to be installed fast, to meet an almost "impossible" production schedule.

Based on recommendations of General Electric engineers, this plant got one of the finest and most dependable power distribution systems ever installed in an American factory. What's more, they got it in record time.

All power used throughout the plant flows through standard G-E Metal-clad switchgear. Supplied factory-assembled, ready for installation, it saved months of time-consuming on-the-job engineering and assembly. Having the entire power distribution job handled as a co-ordinated project by G-E engineers was an essential part of the excellent planning that resulted in starting production three months ahead of schedule.

For examples of the equipment used, see the pictures at left and above. For information on how similar equipment can help your modernization or expansion plans, send for Bulletin GEA-5600, "Electric Power for Industry's Third and Biggest Expansion"—or call your local G-E Apparatus Sales Office. General Electric Company, Schenectady 5, New York.

854-47

GENERAL  **ELECTRIC**

*The most significant advance
in convertibles since the push-button top*

**Sun-resistant tops
of Du Pont ORLON*
keep their good looks
for years!**

Now available on all Hudson convertibles



There's a new kind of top on this Hudson Hornet, and it will still be on the job after years of use. It's the remarkable new top of 100% Du Pont "Orlon" acrylic fiber. It is more resistant to the weakening effects of the sun's rays than any fabric top ever used before. In resisting sunlight, it overcomes the chief cause of convertible-top failure.

This top holds its shape, won't shrink or draw after exposure to the elements . . . keeps its lustrous good looks for a long, long time. It is easy to clean with a solution of mild soap or detergent. It will not balloon excessively at high speeds. And even after repeated raising and low-

ering, it retains its neat appearance.

Because of these advantages—and especially because of the advantages of sun and weather resistance—the Hudson Motor Car Company is making tops of "Orlon" available on every convertible it manufactures. Hudson is the first automobile manufacturer to bring to its customers the many long-lasting advantages of convertible tops of "Orlon" that make their convertibles more salable in such a striking way. The "Orlon" topping is a product of the Landers Corporation, Toledo, Ohio.

Drivers who have tested tops made of "Orlon" report that the tops are

breaking all past performance records for durability. And experiments under the strong Florida sun have proved that the tops will take years of continual exposure without appreciable damage.

HOW DU PONT "ORLON" HELPS INDUSTRY

Hudson is just one manufacturer that is benefiting from the unique combination of properties found in "Orlon." The properties include unprecedented acid resistance, too, and good abrasion and stretch resistance. The fiber has high strength, wet or dry, and retains its press in clothing fabrics. Perhaps you can make a better product or improve a production process with "Orlon." Write E. I. du Pont de Nemours & Co. (Inc.), Textile Fibers Department, Room N-2504C, Wilmington 98, Delaware.

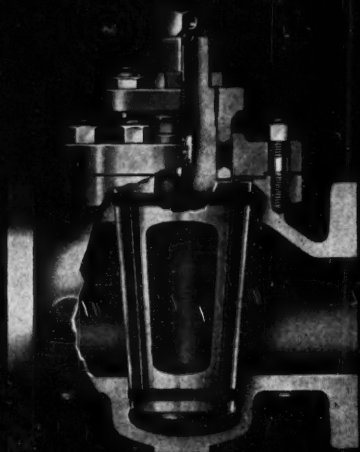
**"ORLON" is Du Pont's trade-mark for its acrylic fiber.*



Many fine manufacturers make fabrics of "Orlon"—the acrylic fiber which is made and supplied to them by Du Pont. Look for its extra values in more and more products for home and industry.

150th Anniversary

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



W

LUBRICATED PLUG

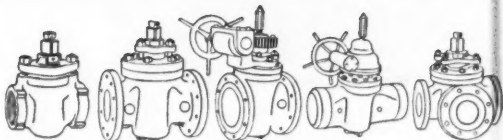
COMPLETE LINES OF LUBRICATED PLUG VALVES

Because of the wide range of services to which Lubricated Plug Valves can be adapted, they may be classed as "all-purpose" valves. Walworth manufactures complete lines of Lubricated Plug Valves in a variety of types and materials for working pressures up to 5,000 psi and for vacuum services. Sizes range from ½ to 30 inches. Write for descriptive literature.

Walworth also manufactures complete lines of gate, globe, angle, and check valves made of steel, bronze, iron, and special alloys.

Walworth valves, pipe fittings, and pipe wrenches total approximately 50,000 items and are sold through distributors all over the world.

Walworth engineers will be glad to help you with your problems. Call your local Walworth distributor, nearest Walworth sales office, or write to our General Offices, 60 East 42nd Street, New York 17, New York.



Illustrated in section is a Walworth No. 1700F Regular Gland Type, Wrench Operated, Steeliron, Lubricated Plug Valve. This particular line of valves has a working pressure rating of 200 psi at 150F or 125 psi at 450F. Sizes range from ½ to 8 inches. Other Walworth Lubricated Plug Valves include Single Gland and Ball Bearing types. They are available for a variety of working pressures.

For best results use Walworth Lubricants and Walworth High Pressure Lubricant Guns.

WALWORTH

Manufacturers since 1848

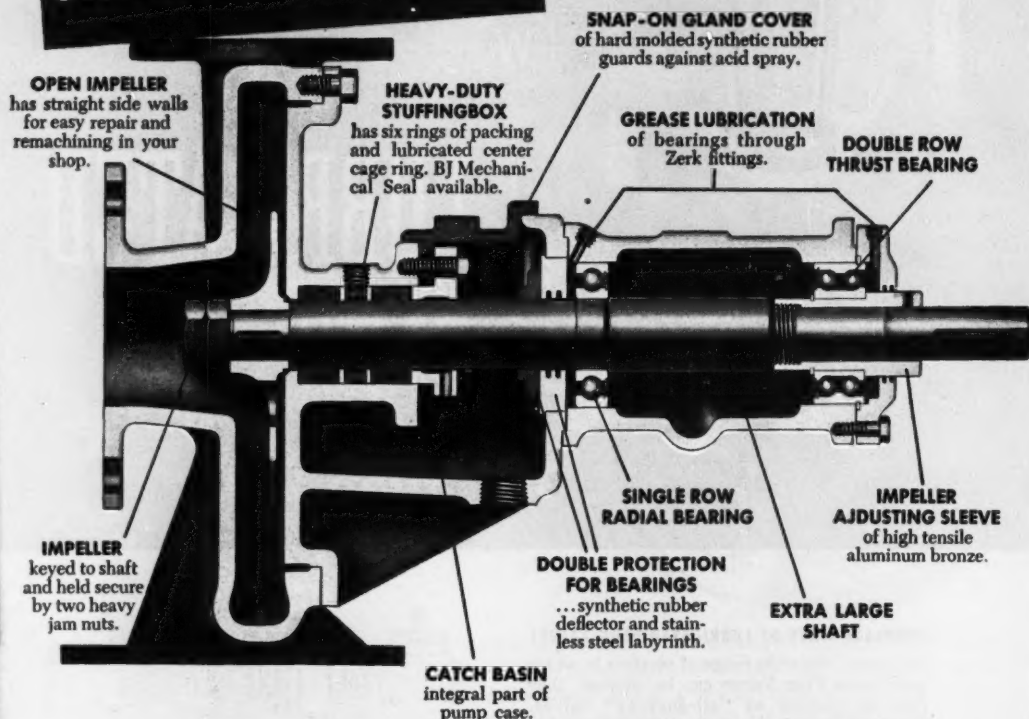
valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

NEW BJ CHEMICAL PUMPS

Here are chemical



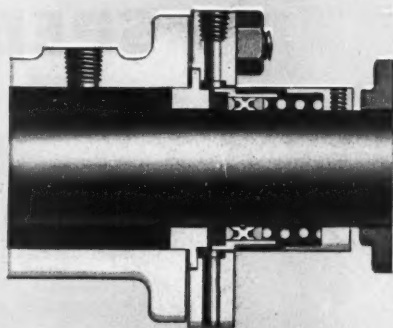
**You've asked for them...
now BJ introduces these
special construction features!**

- *Quick and easy dismantling* for inspection and repair without disturbing piping or driver.
- *All parts interchangeable* except pump case and impeller. Four different pump sizes can be used on one basic stuffingbox and bearing bracket assembly.
- *Corrosion-resistant catch basin*—integral part of pump case—guards bearing bracket and base plate from corrosive leakage.
- *Adjusting sleeve* permits compensation for impeller wear—allows easy adjustment without dismantling.
- *Grease lubrication* gives bearings greater protection against acid fumes. Deflector and labyrinth provide double protection against liquid entrance.
- *Cored passages* through impeller web keep stuffingbox under suction pressure.

pumps engineered to your demands...

You—the chemical pump user—dictated the design of these new BJ Chemical Pumps. Before Byron Jackson engineered these new BJ models, chemical pump users were asked what features were wanted most. Now these improved features are yours in the new BJ Chemical Pumps. Four pump sizes are available (1", 1½", 2" and 3") with capacities to 450 gpm and heads to 100 feet.

BJ Mechanical Seal also available for protection against leakage. BJ's Type "A" Mechanical Seal is designed especially for the particular demands of chemical pumping. It replaces the packing and provides positive protection against leakage to the bearings or contamination of the pumped liquid. All major parts of this BJ-designed seal are effectively isolated from contact with pumped liquid. Available as special construction, the BJ Mechanical Seal will save you maintenance time and money by eliminating frequent repacking.



YOU BENEFIT FROM MAXIMUM INTERCHANGEABILITY OF PARTS!

All parts except pump case and impeller are *completely* interchangeable. Four different size BJ Chemical Pumps fit one basic assembly! This means that only a few spare parts are needed to service a wide range of pumps.

FOR MORE INFORMATION
on these new pumps, write
BJ Chemical Pump Dept. 5.

BJ makes a complete line of centrifugal pumps to answer your other pumping needs.

Byron Jackson Co.

Since 1872

P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

Jones

WORM-HELICAL SPEED REDUCERS



Jones Worm-Helical Speed Reducers are high efficiency units built in fifteen standard ratios from 40 to 1 to 250 to 1 for all common motor speeds. They are ideal for vertical shaft drives to agitators, mixers, bending rolls, etc.

The low speed shaft can be extended up or down, for coupling connection or gear drive.

Bulletin No. 75 covers complete details.

W. A. JONES FOUNDRY & MACHINE CO.
4415 W. Roosevelt Rd., Chicago 24, Ill.

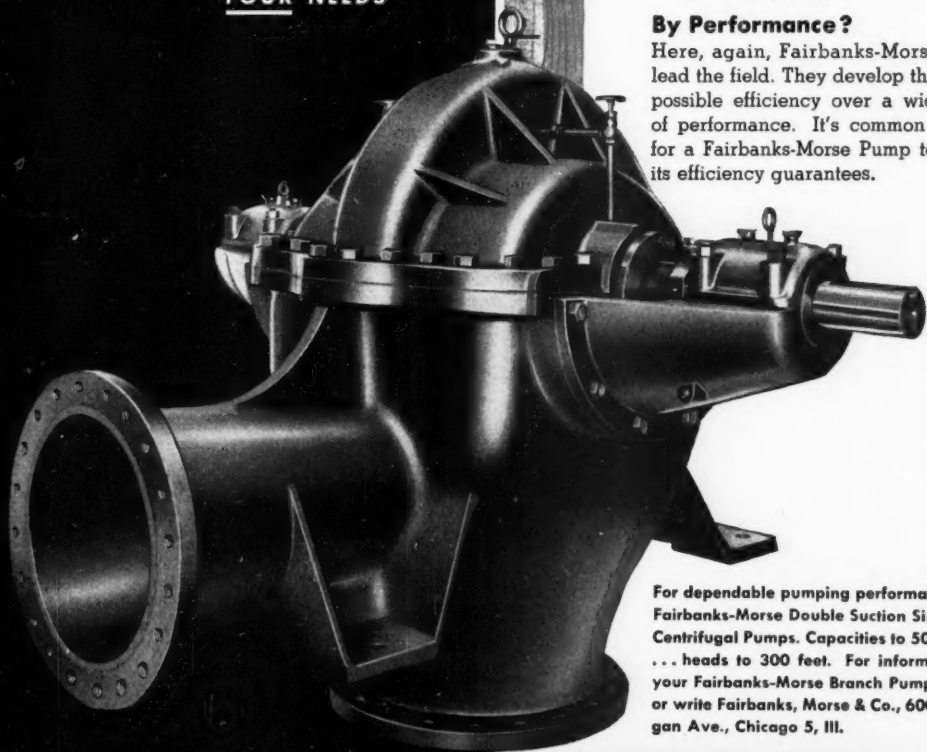
Since 1890
Jones
In The Service Of Industry

WORMS — WORMS — SPUR — GEAR SPEED REDUCERS
CAST IRON PULLEYS • CAST GEAR • SAFETY BRAKES
ANTI-FRICTION BEARING MOUNTS • FLEXIBLE COUPLINGS

By any
Yardstick...

FAIRBANKS-MORSE

MEASURES UP TO
YOUR NEEDS



How do you measure large centrifugal pumps for your pumping needs?

By Dependability?

Fairbanks-Morse scores top ratings here. Rugged design and construction . . . careful testing . . . years of successful application make Fairbanks-Morse Centrifugal Pumps a preferred choice for dependability.

By Ease of Servicing and Maintenance?

Fairbanks-Morse Pumps are noted for their minimum maintenance requirements. And, when servicing is needed, Fairbanks-Morse accessibility makes it fast and easy. For example, the entire rotating impeller element can be removed without disturbing driver, suction or discharge piping.

By Performance?

Here, again, Fairbanks-Morse Pumps lead the field. They develop the highest possible efficiency over a wide range of performance. It's common practice for a Fairbanks-Morse Pump to exceed its efficiency guarantees.

For dependable pumping performance, check Fairbanks-Morse Double Suction Single Stage Centrifugal Pumps. Capacities to 50,000 GPM . . . heads to 300 feet. For information, see your Fairbanks-Morse Branch Pump Engineer or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.



FAIRBANKS-MORSE,

a name worth remembering when you want the best

PUMPS • DIESEL LOCOMOTIVES • ELECTRICAL MACHINERY • SCALES • HOME
WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS

HOW MUCH DO FILTER

Have you ever thoroughly investigated both the direct and indirect cost of filter cloths in your plant? If not, the chances are you will be surprised to find that annual cloth replacement and maintenance cost alone runs from \$1.00 to \$4.00 per square foot of press area per year, depending on the utilization of your press, the product and the type of fabric you use.

Other costs associated with use of cloths, such as the labor for scraping, handling, washing; breaking and redressing the press; and purchasing time expended in obtaining the cloth you need when you need it will probably be even greater, even if not as easily pinned down.

Here then are three immediate reasons why you should consider switching to modern high-speed Niagara pressure leaf filters:

1. Niagara filters require no filter cloths. Accurate case histories in our files show that some plants amortize their Niagara filters in a few years on this saving alone.

2. Niagara filters require less labor. When you eliminate filter cloths, you eliminate the back-breaking and costly labor that goes with them. With Niagaras you get a quick, easy, clean operation that takes only a few minutes for one man between cycles.

3. Niagara filters work harder for you. Reduced downtime means more production time and therefore higher production at your filter station. The filter works for you more hours per day—gives you many more gallons throughput with less installed filter area.

By switching to Niagaras, many press users have realized over-all savings that amortize the cost of the

new filters in months.

Entirely aside from savings, here are nine sound reasons for installing Niagara Filters:

1. Higher flow rates on an equal area basis. Niagaras normally give flow rates 2 to 5 times those of conventional cloth-covered filter presses. This is because the rigid metal screens do not "give" under pressure—cannot obstruct flow channels in the drainage member as does sagging fabric cloth.

2. Sparkling filtrate clarity. Positive removal of solids to practically any degree of clarity you desire. In sanitary applications, 0-0 bacteria count can usually be secured in one filtration.

3. No leakage. Fully enclosed, pressure-tight construction eliminates drippage and fumes. Ideal for handling flammable, explosive, toxic, volatile, or highly obnoxious liquids.

4. Excellent cake-washing characteristics. Nearly true displacement washing is obtainable. Wash liquid is a minimum.

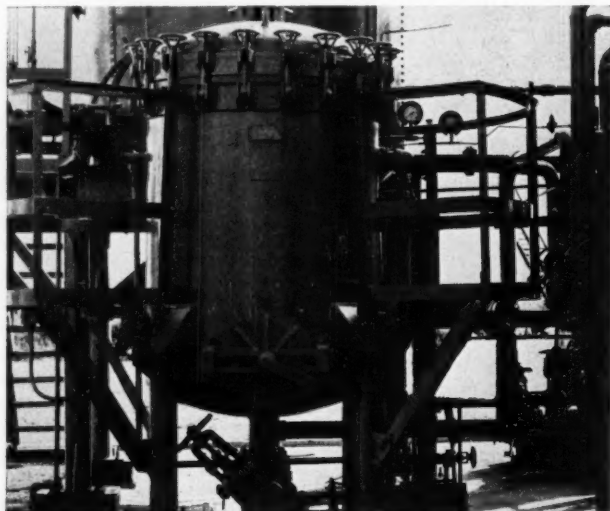
5. One-man operation and cleaning. Single or multiple units can be operated and cleaned easily by one man. The entire leaf battery is accessible for easy cleaning.

6. Corrosion resistance. The pressure leaf filter can more cheaply and readily be constructed of stainless steel, nickel, monel and other corrosion-resistant materials.

7. Jacketed construction. Niagaras can readily be supplied with steam jackets or special insulation.

8. Wide capacity range. Sizes range from 20 to 950 square feet of filter area, with average capacity of 10 to 425 G.P.M. in one compact unit. (Even larger areas are available in the new horizontal filter shown at right on the opposite page.)

9. Lower maintenance cost. There are no moving parts during filtration. Simple construction, with fewer parts to wear out, means low-cost upkeep.

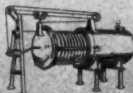


THIS NIAGARA FILTER, in large petrochemical plant, removes iron sulfide particles from solutizer solution.



Niagara Filter
CORPORATION

IN EUROPE—NIAGARA FILTERS EUROPE, 36 Leidsegracht, Amsterdam-C, Holland



HORIZONTAL
for non-aqueous
liquids; high
solids; cake re-
covery.

CLOTHS COST YOU?

NEW NIAGARA STYLE H* FILTER

Low cleaning time . . . no cloth cost

This new Niagara filter answers the need for a filter which can quickly discharge large quantities of semi-dry cakes. A variation of the standard Niagara design, it still retains all the basic advantages of Niagara vertical pressure leaf filters.

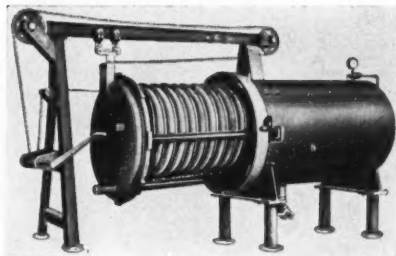
A retractable carriage permits all leaves to be withdrawn at once for rapid cleaning. One man can easily discharge as much as 150 cu. ft. of semi-dry cake in a matter of minutes merely by rapping the leaves.

A new closure design, the Q/O*

(quick-opening) cover, permits faster, easier opening and closing than ever before in a filter of this size.

The Style H filter, available in sizes up to 1500 sq. ft., is ideal for filtration where high percentages of solids must be removed or where solids must be recovered. It is also recommended for standard liquid clarification where low headroom or other special reasons make its horizontal construction preferable to a vertical filter.

*Trade Mark Patent Applied For.



HOW THE NIAGARA FILTER WORKS

The leaves, which are the heart of the filter, consist of double-faced screen assemblies bounded by a tubular drainage frame leading to an outlet nozzle.

The unfiltered liquid usually with filteraid in suspension is pumped into the closed pressure filter tank in which the leaves are placed, and is forced through the fine-mesh screens, on which the filter cake is formed by the solids in the liquid.

Only the clear liquid reaches the inside of the leaves, flowing through the coarse center drainage wire to the tubular frames, and out through the

leaf nozzles to the manifold.

When the batch has been completely filtered, or when the cake has nearly filled the space between the leaves, the filter is emptied and the filter cake is sluiced from the leaves with a hose or with automatic high-pressure sprays. Sluicing is done without removing any parts from the filter. (Cake removal for the Style H filter is somewhat different, as described above.)

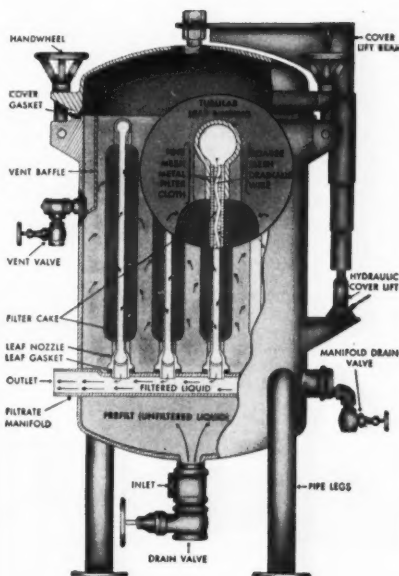
As a rule, the filter is ready to go to work again in 15 minutes to one hour, depending on its size.

THESE 5 SERVICES HELP MAKE HIGH-SPEED, LOW-COST FILTRATION A REALITY IN YOUR PLANT:

- 1. Nationwide field service.** Niagara representatives in 24 cities know filtration and can give you facts.
- 2. Modern filtration laboratory** determines your requirements accurately by test-filtering samples of your materials.
- 3. Pilot filter rental plan** enables you to "preview" Niagara performance in your plant, at low cost.
- 4. Custom engineering.** A single filter or a complete system, designed for your needs and built in materials of your choice.
- 5. Installation and start-up** are supervised by Niagara factory engineers, always on call.



PILOT FILTER duplicates operation of large production models.



Operating figures prove the economic soundness of replacing cloth-covered presses with Niagara filters. For details, write us today. Or mail the coupon for descriptive literature.



NIAGARA FILTER CORP., 3867 Main St., Buffalo 14, N. Y.

Please send: ☐ General literature; ☐ Data on horizontal filters; ☐ Data on pilot filter rental

Name _____

Title _____

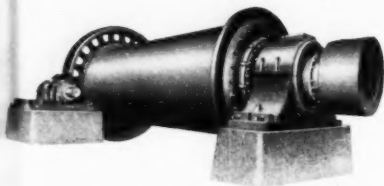
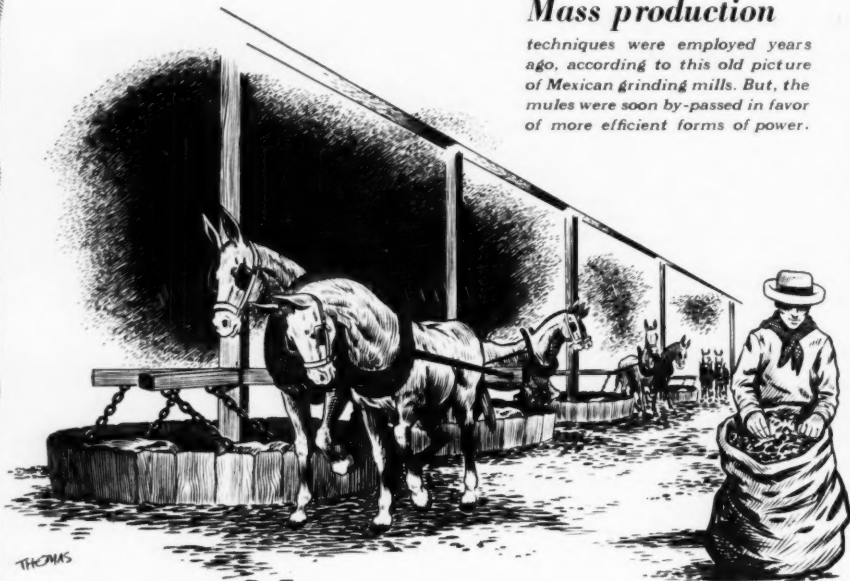
Company _____

Address _____

City _____ Zone _____ State _____

Mass production

techniques were employed years ago, according to this old picture of Mexican grinding mills. But, the mules were soon by-passed in favor of more efficient forms of power.



Traylor Grinding Mills produce a uniform, high-quality product at modern rates of production. Write for information on any of these types: Ball, Rod, Compartment, and Pebble Mills.

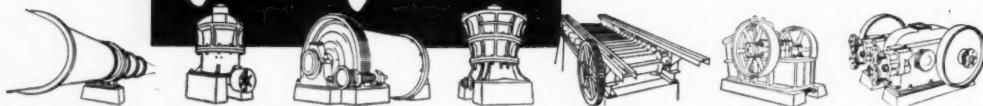


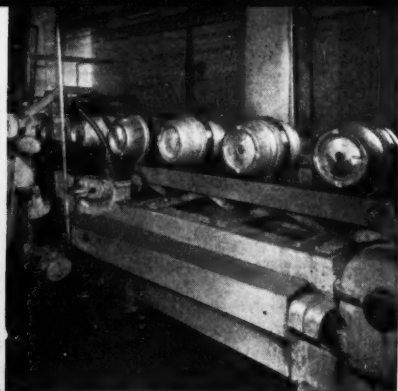
TRAYLOR ENGINEERING & MANUFACTURING CO.
491 MILL ST., ALLENTOWN, PA.

SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs. Canadian Vickers, Ltd., Montreal, P. Q.

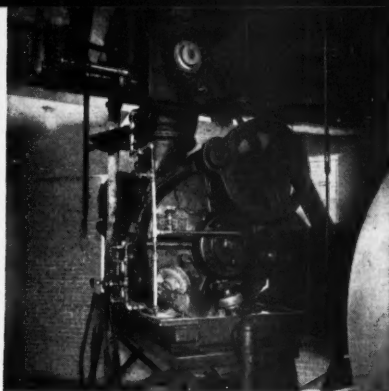


leads to greater profits

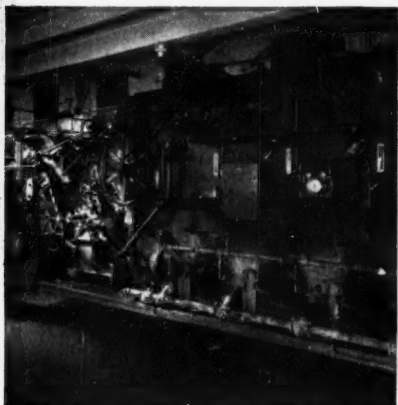




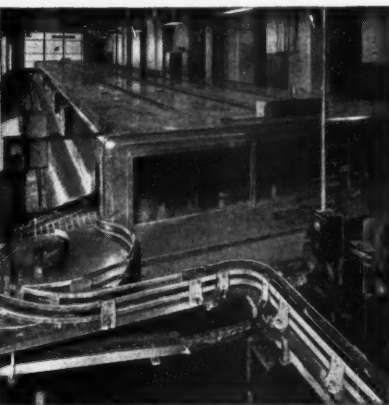
Keg scrubber—A constant stream of water at 130°F. plays over these barrels and reaches bearings on conveyor.



Wet-grain press—After being heated to 180°F., grain is then pressed dry. Hot water comes in contact with bearings.



Bottle soaker and washer—Bottles are first cleaned with strong alkali at 180°F., then washed with water. These conditions make bearing lubrication difficult.



Pasteurizer—Beer is pasteurized in this modern machine which is subjected to constant water spray ranging from 80°F. to 140°F.

No trouble brewing for bearings!

A midwest brewing plant employed seven different greases in a variety of applications. Despite the use of these special products, the operators experienced difficulty. The greases would not withstand both water and high temperatures. Frequent applications were necessary.

A Standard Oil lubrication specialist was called in on this problem. Upon his recommendation, STANOLITH Grease—a lithium-soap product with the ability to withstand both heat and water—was given the job.

As a result, STANOLITH has replaced all seven greases formerly used and *has done a better job in each type of application.* Through its use over a two-year period, grease consumption has been reduced 20% and time spent in applying grease cut 50%.

STANOLITH Grease can prove its remarkable versatility in your plant, too. Its high mechanical and chemical stability plus its extreme resistance to heat and water quali-



fies it to replace a variety of special greases.

To obtain maximum benefits from STANOLITH, use the services of a Standard Oil lubrication specialist. His headquarters are near your plant. How you can benefit by his on-the-spot service is explained at the right. Standard Oil Company, 910 South Michigan, Chicago 80, Illinois.

What's YOUR problem?



Mr. D. V. Wills of Standard Oil's South Bend office is the lubrication specialist who helped this Midwest brewing company solve a difficult lubrication problem.

He is one of many Standard Oil specialists located throughout the Midwest. These men have the practical experience and special training to handle lubrication problems on any type of operation.

Take advantage of the service offered by the lubrication specialist nearest your plant. You can reach him by phoning your local Standard Oil Company (Indiana) office. Why not call, today, and arrange to discuss with him the advantages offered you by STANOLITH and other outstanding products such as:

STANOIL Industrial Oils—This general-purpose line of oils provides cleaner operation of hydraulic units and supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

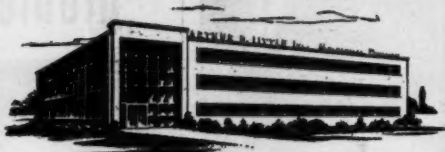
SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types, SUPERLA Greases cover a wide range of applications. These efficient products are comparable in quality with the highest type of special greases.

STANORUST Rust Preventives—The eight grades of STANORUSTS form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD OIL COMPANY



(Indiana)



New ADL Mechanical Division Building

UNIQUE PROTOTYPE DEVELOPMENT

... using advanced Engineering Techniques



Design and construction of 400 gallon capacity vessels to contain liquefied gases near 400 degrees below zero F was a recent example of ADL prototype development.

Reducing costly evaporation losses took high-vacuum insulation at a pressure of 1×10^{-6} mm Hg, as well as knowledge in extreme low temperature engineering — even under severe transportation heat leaks of only 1/12 watt/sq. ft. occurred.

ADL experience in many areas of science and engineering produced this unique prototype.

If lack of personnel has halted development of your new ideas or new products, the ADL Mechanical Division can take over and bring them to complete maturity.

Arthur D. Little, Inc., has blended its scientific and engineering skills in the Mechanical Division to provide industry with a unique service ... prototype development of equipment requiring a high level of engineering. Scientists in the fields of chemistry, physics, metallurgy, mathematics, biology, electronics and technical economics can be called on as required.

Our staff is experienced in interpreting the ideas of industry and following through with the perfection of specialized equipment.

THERMODYNAMICS • HEAT TRANSFER • REFRIGERATION TO MINUS 456 F • VACUUM ENGINEERING • GAS LIQUEFACTION • ELECTROMAGNETISM • MECHANICAL DESIGN • VIBRATION

Write for Brochure CE 16-1

MECHANICAL DIVISION

Arthur D. Little, Inc.

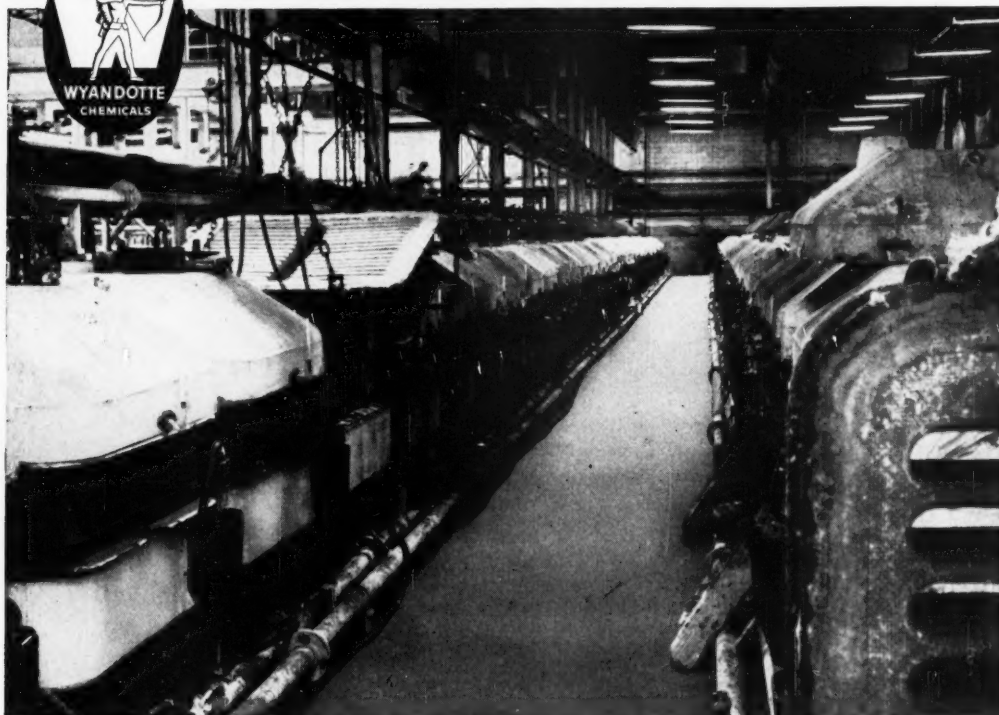
CREATIVE TECHNOLOGY SINCE 1886



30 MEMORIAL DRIVE, CAMBRIDGE, 42, MASS.



Dependable Source for Chemical Raw Materials



Production from this and other Wyandotte chlorine-caustic cell rooms is being increased.

BULLETIN BOARD

Dicol®:

This mixture of diglycols, predominantly diethylene glycol, has shown outstanding efficiency in plasticizing and humectant applications . . . plus up to 20% savings! Write for samples, data.

Kreelon® CD:

The only product of its kind on the market, Wyandotte Kreelon CD combines the advantages of a synthetic detergent and a detergent-promoter. Produces long-lasting suds . . . reduces skin irritation. Kreelon CD offers as high as 70% improvement of detergency in cotton cleaning. Write for details.

Soda Ash, Caustic:

Supply of these basic chemicals is adequate for the present; and we're increasing production to meet the expanding needs of industry.

Purecal:

Recent advances in GRS compounding and processing, using this whitest pigment extender known (Wyandotte's precipitated calcium carbonate), warrant cost comparison with cheapest natural-rubber formulas. Other profitable applications: paint, paper, ink manufacture.

Wyandotte expands chlorine production

Current expansion of chlorine production at Wyandotte is intended primarily to meet the needs of fast-growing market requirements.

If your needs for chlorine are increasing, let us know what you expect them to be; and if you have any chemical problems arising from increased production, tell us about them. That way we can do a better job of servicing you, now and in the future.

Centrally Located

Wyandotte, with over 62 years' experience, has the know-how and facilities to take care of its customers. Our central location, on one of the world's great waterways, on major railroads and several ma-

jor truck lines, helps assure a steady, continuing supply of chlorine, soda ash, bicarb, caustic and other chemical raw materials.

Wyandotte's company-owned resources are your guarantee that we can produce and deliver. Read the "Bulletin Board" for the latest facts on other Wyandotte products. And for further information, write *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in Principal Cities.*

*REG. U.S. PAT. OFF.



Wyandotte
CHEMICALS

CORROSION affects every plant in the Chemical Industry

MILLIONS OF DOLLARS ARE LOST ANNUALLY

1 Your Hard-to-Get Equipment

... may be ruined by constant attack of acids, alkalis, fumes, chemicals, moisture, gases and weathering.

2 Your Valuable Products

... are subject to contamination and loss whenever they are in contact with corroded surfaces.

3 Expensive Shutdowns

... and loss of production with costly man-hours for repairs may be incurred unnecessarily.

4 Your Profits

Ruined equipment, contaminated products, the loss of production and repair expense caused by shutdowns mean only one thing ... reduction in *your* profits!

RIGHT NOW...you should investigate the economies of using Amercoat; a line of coatings built to protect against *specific* industrial corrosion hazards.

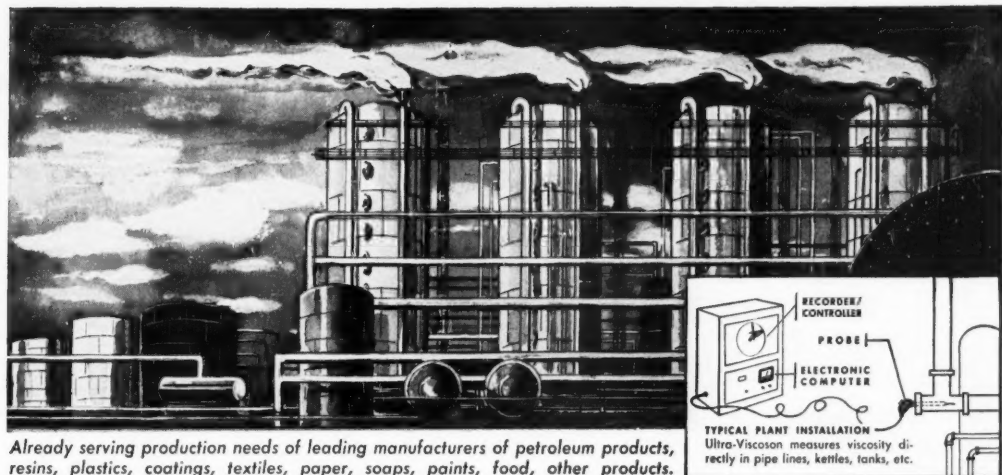
Our field engineers are available...without obligation...to check your plant for corrosion problems...and to give you *specific* recommendations.

AMERCOAT CORPORATION

A Division of American International Corporation, Inc.
4609 FIRESTONE BLVD., SOUTH GATE, CALIFORNIA

PROBE INTO IT...

measure • record • control **VISCOSITY** continuously



Already serving production needs of leading manufacturers of petroleum products, resins, plastics, coatings, textiles, paper, soaps, paints, food, other products.



AUTOMATICALLY MEASURES VISCOSITY WITH ULTRASONICS

- ✓ No moving parts. Simple. Reliable.
- ✓ Hermetically sealed probe.
- ✓ Temperature: Up to +650°F
- ✓ Pressure: Vacuum to 1000 p.s.i.
(special units available for higher pressures)
- ✓ Controls quality: Electrical output of computer actuates recording and control systems.

The **ULTRA-VISCOSON** gives unique competitive advantages to products where viscosity measurement and control are important factors. Provides continuous measurement without stopping for sampling. Provides recording and control while production is going on. Readily installed in pipe lines, kettles, tanks, etc., singly or in multi-probe systems. An inquiry about the applications in your own field will be given prompt attention. Special systems to meet specific requirements can be furnished.

probe into it . . . with

ULTRA-VISCOSON

THE ULTRA-VISCOSON CORPORATION

1240 Main Street

Hartford 3, Conn.

Another hazardous

by installing

CROUSE-HINDS

Explosion-Proof CONDULETS*

The photographs below show an electrical control center for power and lighting circuits in a chemical plant.

This is an area in which non-explosion-proof equipment was reasonably safe at the time of the original installation. At a later date, changing conditions with the use of flammable solvents created a definitely hazardous location. With electrical devices and wiring housed in non-explosion-proof enclosures, the safety of the entire plant was threatened.

This perilous situation was promptly corrected by an installation of Crouse-Hinds Explosion-Proof CONDULETS as shown in the photograph at the right. In addition to protection against explosion, the CONDULETS reduced maintenance by providing protection against corrosion.

ARE THERE SIMILAR CONDITIONS IN YOUR PLANT?

A careful survey of your plant might reveal that there are unprotected areas where there is a possibility of the presence of explosive atmospheres in dangerous concentrations. Such conditions are a constant source of danger . . . possibly disaster!

Remove the danger by putting in an installation of Crouse-Hinds Explosion-Proof CONDULETS . . . the complete line that gives you thousands of items from which to select the ones that exactly fit your needs.

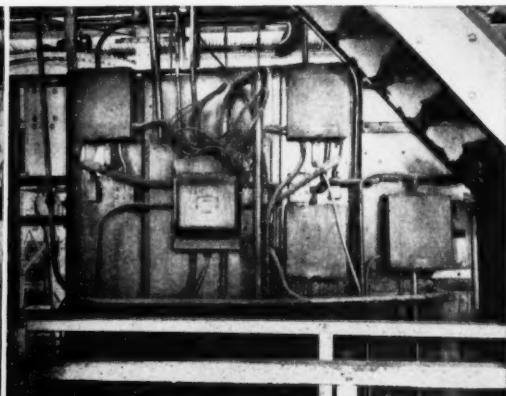
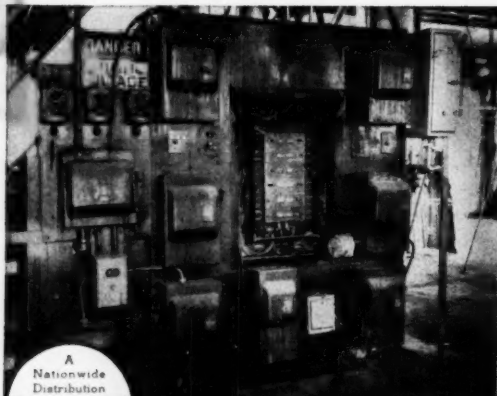
CROUSE-HINDS COMPANY Syracuse 1, N. Y.

OFFICES: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New Orleans — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Tulsa — Washington.
RESIDENT REPRESENTATIVES: Albany — Atlanta — Baltimore — Charlotte — Corpus Christi — Richmond, Va.
Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

Explosion-Proof CONDULETS

- ① Type EDP Lighting Panelboard
- ② GUA Series Junction Condulets with Dome Covers
- ③ Type EFS Pushbutton Stations
- ④ Type EPC Combination Line Starters
- ⑤ Type FLB Circuit Breakers
- ⑥ Type FLF Manual Starters
- ⑦ Type EYS Sealing Condulets

* CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

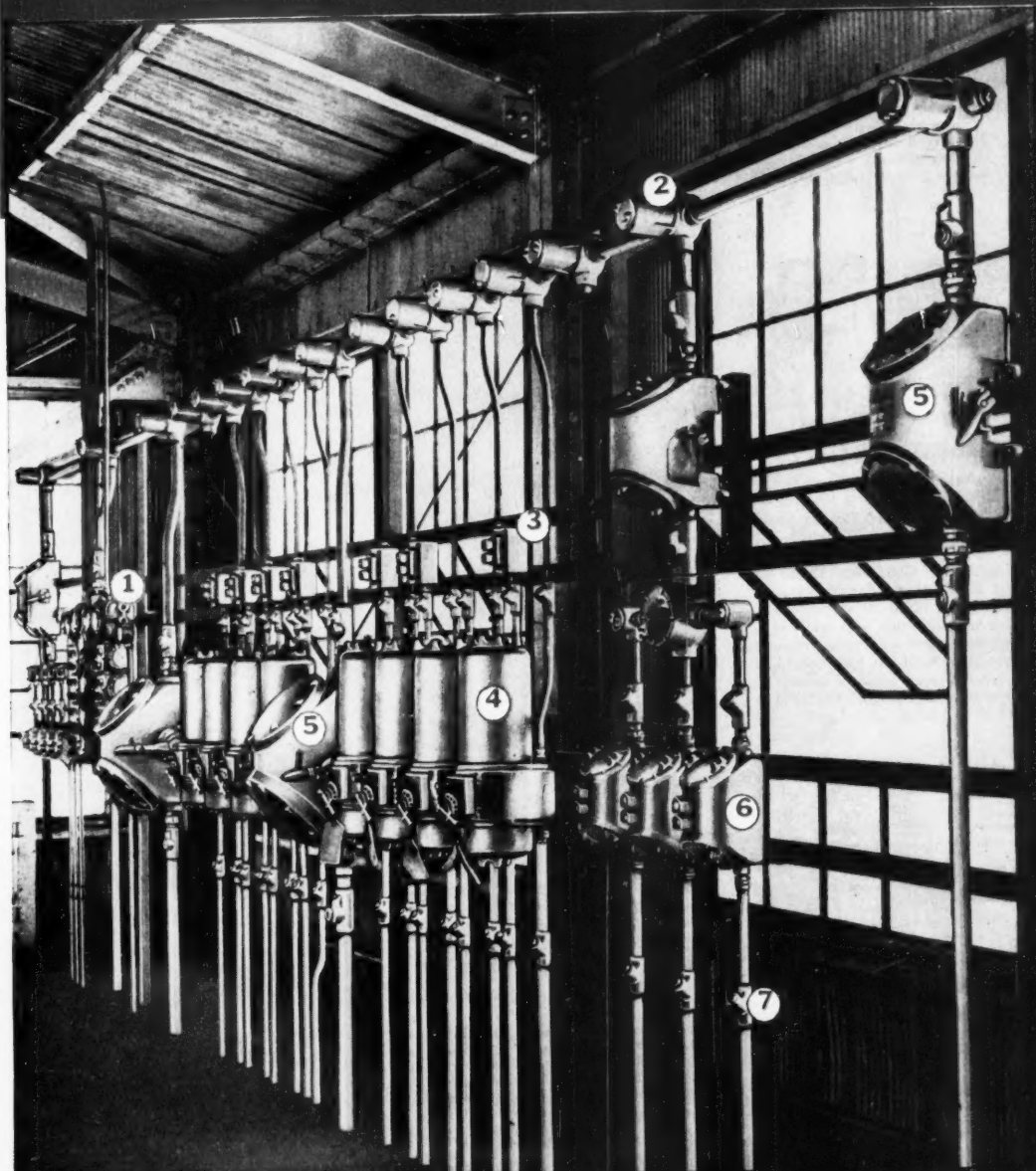


BEFORE

CONDULETS

AIRPORT LIGHTING

*area made **SAFE***



AFTER CONDULETS were installed

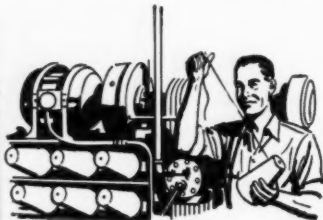
TRAFFIC SIGNALS

FLOODLIGHTS

American Blower...a time-honored name in air handling



New York City has a conveniently located American Blower Branch Office to provide you with data and equipment for air handling. You can reach American Blower in New York by calling BRyant 9-2885. In other cities, consult your phone book.



YARN ABOUT YARN . . .

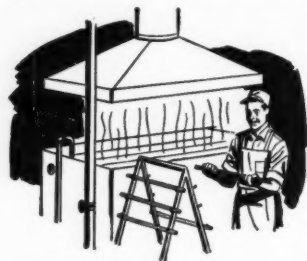
A textile manufacturer was continually changing pulleys or setting the machine rate on his ring-spinning frames to fit the material that worked at the lowest speed. He'd heard about American Blower Gyrol Fluid Drives and decided to try them. Results were amazing. Gyrol Fluid Drive permitted a higher output within safe limits of the material, allowed spinning frames to start gradually with less yarn breakage. For your business, wouldn't smooth power transmission and adjustable speed control be a distinct advantage?



FOOD FOR THOUGHT . . .

Those magnificent new supermarkets springing up around the country are just as comfortable as they are modern. Many use American Blower Ventura Fans for ventilation the year round,

and Venturafin Unit Heaters for winter heating. They meet a twofold requirement. First, both units are beautifully styled to harmonize with modern designs. Second, both units are quiet-operating—a necessity in modern stores. Our nearest branch office will be glad to furnish price and delivery data.



FUMES, VAPORS, GASES . . .

In addition to a wide range of standard ventilating equipment for industry, American Blower also offers special fans to handle corrosive gases, fumes, vapors. Some corrosive gases are vital to process work and must be circulated in the system with corrosion-resistant fans. Gases and fumes which affect the health and comfort of employees must be removed. There is an American Blower corrosion-resistant fan that will meet your requirements for those special applications in the process industry.

Whatever your needs, American Blower heating, cooling, drying, air conditioning and air handling equipment will improve over-all comfort and efficiency in your business. For data, phone or write our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

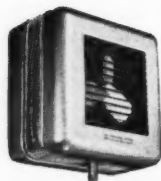
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

**YOUR BEST
BUY**

AMERICAN  BLOWER

**AIR HANDLING
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Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



Unit Heaters



Ventura Fans



Air Conditioning
Equipment

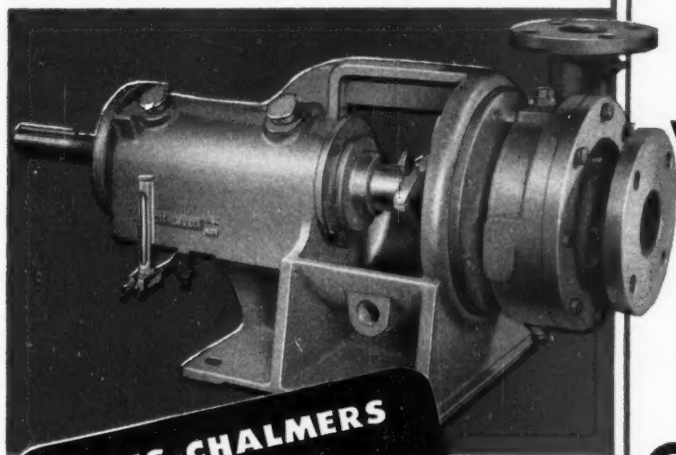


Industrial Fans



Utility Sets

Before you order a costly "special purpose" pump...



ALLIS-CHALMERS
General Purpose
CHEMICAL PUMP

SEE WHAT THIS PUMP CAN DO!

If you can use this pump, you can save your plant hundreds of dollars.

FORMERLY, CHEMICAL MEN had to buy refinery type pumps for handling chemical solutions at 400 to 500 degrees F. There was nothing else to do the job.

Even today some engineers are surprised to find they can buy a general purpose chemical pump for pumping most chemical solutions.

There are several reasons why this Allis-Chalmers pump is able to handle so many chemical pumping jobs:

- Built in most used size range ... to 1200 gpm, 250 ft head.

- Built for most used temperatures ... for liquids to 500 F.
- Made with choice of materials ... and choice of six different sealing arrangements, including a water cooled stuffing box ... somewhat unusual in a pump of this type.
- Loaded with other features, including: large, easily changed reservoir of oil for lubricating the bearings; pedestal of rigid, corrosion resistant cast iron. In addition, there is plenty of room between pump and pedestal for easy maintenance.

Allis-Chalmers can supply you with a complete pumping unit — pump, motor, drive, and control — all of coordinated design and manufacture and all mounted on a rigid base ready to install.

To get more information on Allis-

Chalmers General Purpose Chemical Pumps, call your Allis-Chalmers Authorized Distributor or District Office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 52B7638.

A-3668

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS — 1/2 to 25,000 hp and up, All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.



TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

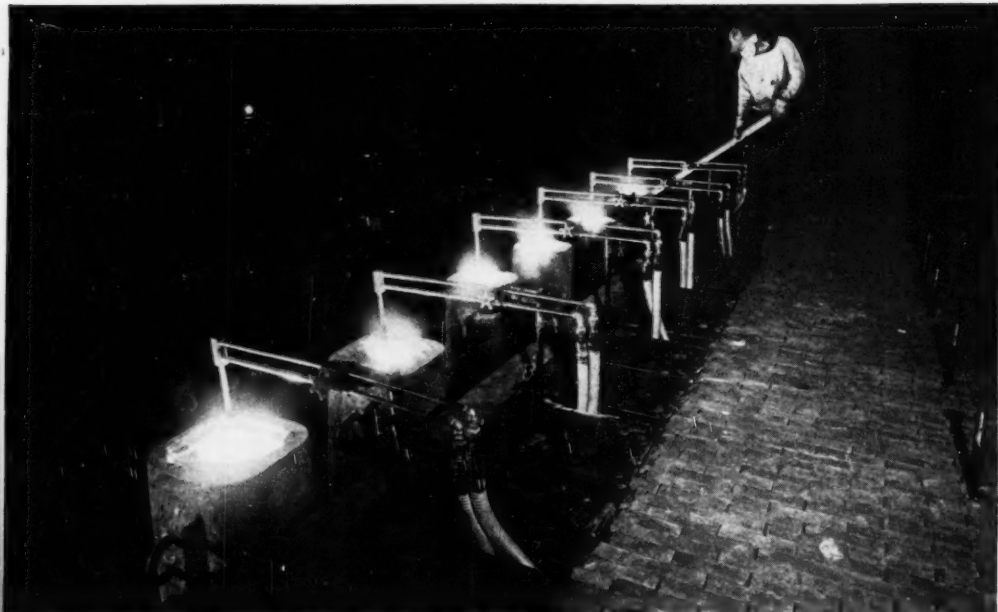
Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS



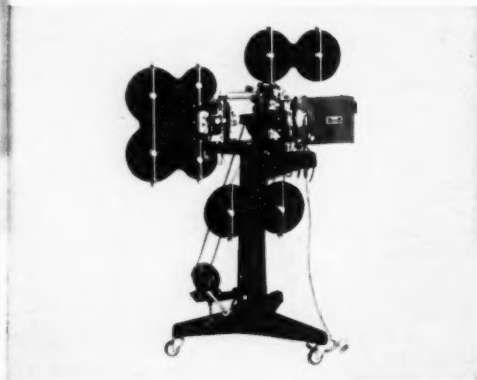
NEWS ABOUT FLEXIBLE METAL CONNECTORS

Here they offer HEAT RESISTANCE, PROTECTION, and ECONOMY

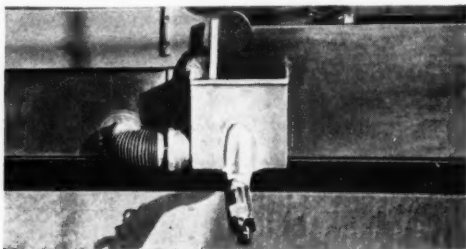


HEAT RESISTANCE The "electric hot topping" process generates a lot of heat. Braeburn Alloy Steel Corp. uses American Flexible Galvanized Steel Tubing to protect wiring from both this intense

heat and impact. American Flexible Connectors can also be made from other metals. Use American Flexible Metal Connectors if your product must move, bend, vibrate, or resist heat, cold or pressure.



PROTECTION American Flexible Shielding Conduit was used on this motion picture film reduction printer. The manufacturer, Oscar F. Carlson Co., desired to protect wiring from crushing and impact. American Flexible Metal Connectors are often the easy solution to a tough design problem. They absorb vibration, protect flexible shafts, connect moving lines, and can be assembled in restricted spaces.



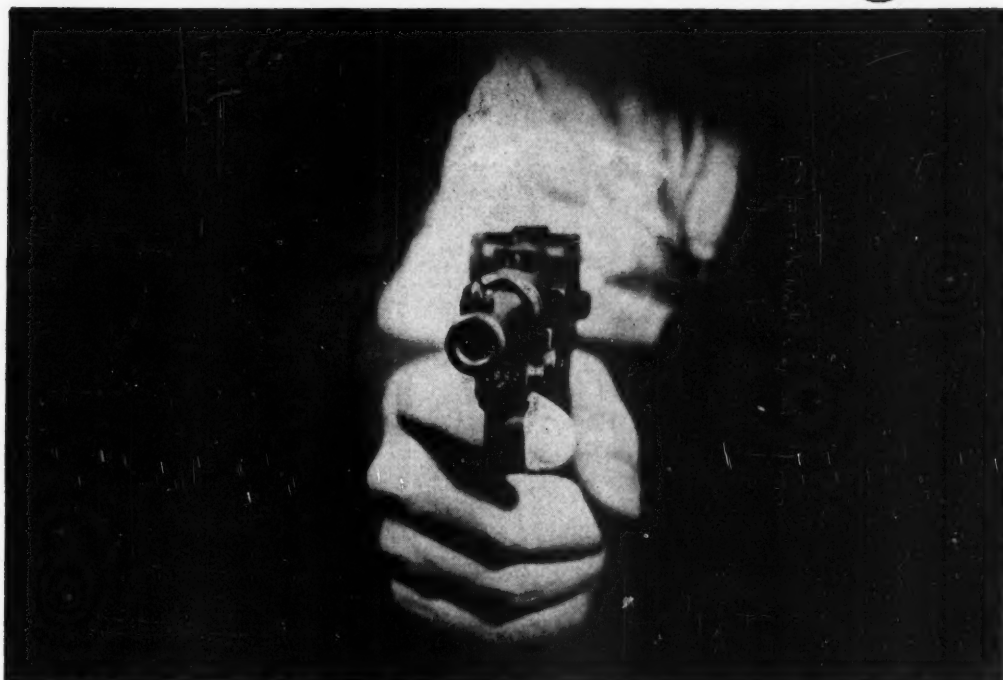
ECONOMY This American Flexible 2" ID Seamless Bronze Tubing is used between flue pan and syruping-off box on a maple syrup evaporator. The George H. Soule Co. chooses this connection because it permits more rapid flow of sap, and absorbs expansion and contraction. To carry air, oil, gases, grinder dust, and many other fluids and semi-solids—American Flexible Metal Connectors should be your first choice, too!

Write for Booklet SS-50: shows how the tubing is designed, used and installed — gives specifications on tubing and fittings. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Co., Ltd. CS281



wherever connectors must move... *American* flexible metal hose and tubing

You can't stop a bullet with a catcher's mitt



You can't stop corrosion with ordinary paints ...
it takes BITUMASTIC COATINGS!

CORROSION can't be stopped by ordinary paints or conventional protective coatings. They can't protect surfaces against the ravages of rust for any appreciable length of time.

But Bitumastic Coatings can!

BECAUSE the six Bitumastic® Protective Coatings, unlike maintenance paints, are specially formulated from a coal-tar pitch base* that is, for all practical purposes, impervious to water. And when you keep moisture away from an exposed surface, you *stop* corrosion.

BECAUSE Bitumastic Coatings provide an extra-tough, extra-thick barrier against corrosive elements—a barrier that is impenetrable.

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BECAUSE Bitumastic Coatings stop corrosion caused by moisture—acid fumes—alkaline fumes—corrosive soil—salt air—heat.

There are 6 Koppers Coatings—formulated to control corrosion of metal and deterioration of concrete. Use the coupon for full information.

*Hi-Heat Gray contains heat-resistant metallic base.

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 Tar Products Division
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CHEMICAL ENGINEERING—October 1952

The platinum metal catalysts are now used for...

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PURIFICATION OF
HYDROGEN, NITROGEN.
PRODUCTION OF
INERT ATMOSPHERES.
REMOVAL OF OXYGEN,
CARBON MONOXIDE FROM GASES.

A gram or a ton...

BAKER RESEARCH SERVICE: Here, the world's largest platinum metal catalyst research and production facilities are maintained for service to you. If catalysis is a part of your present production or if you are contemplating a new process involving a catalytic stage, it may very likely be to your advantage to discuss (in full confidence of course) your catalyst problems with us.

THE LOW COST OF PLATINUM CATALYSIS: Platinum catalysis is in many instances far more economical in actual use than the base metals and oxides. Platinum metals in spent catalyst are recovered or reconverted to new catalyst by Baker at such low cost that its use facilitates economies (holding catalysis costs to pennies-per-ton) even in large-volume operations.

Platinum metals catalysts have many important advantages that warrant your investigation. ★ ★ ★

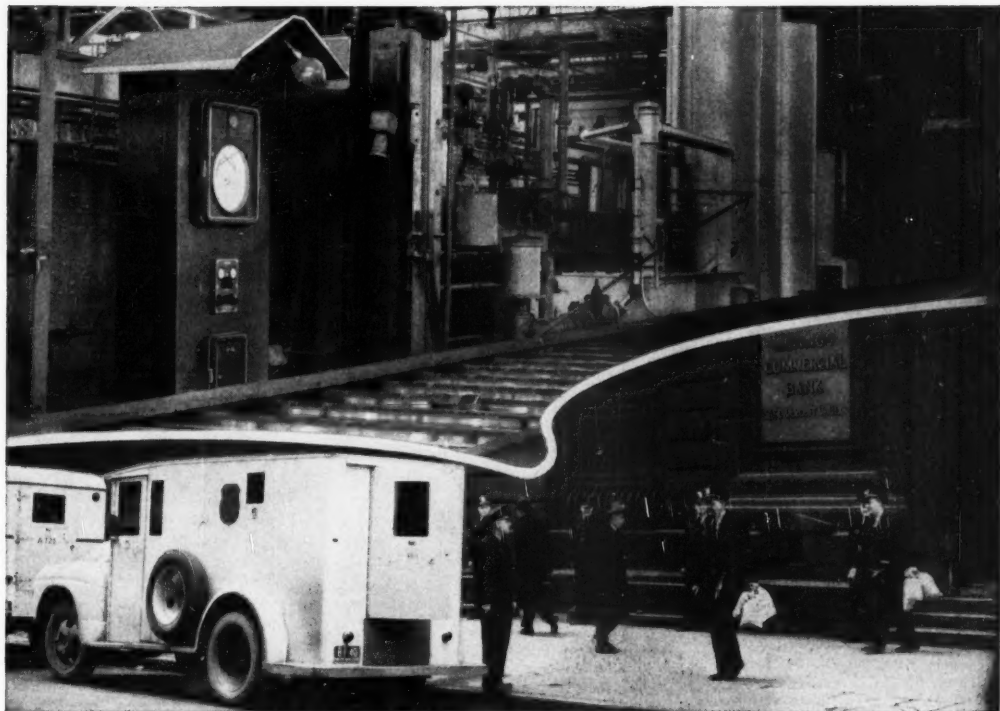
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& COMPANY, INC.
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THE HUB OF PLATINUM METALS RESEARCH



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Are Your Process Materials Guarded As Well?

HERE'S HOW TO PREVENT SPOILAGE AND WASTE...

TO avoid waste of valuable process materials and finished products, process rates and conditions must be accurately measured and controlled. That's where Bailey Meters, Analyzers and Controllers can help you to improve the efficiency of your plant.

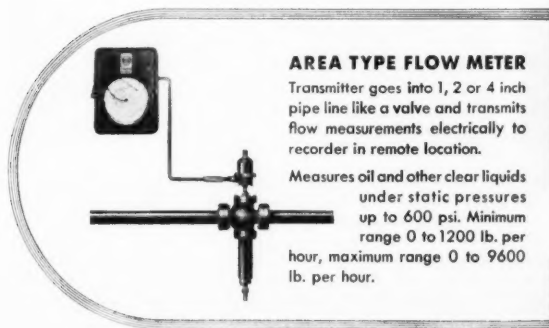
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flow in pipes, open channels, ducts, furnaces, smelters, kilns, ovens, dryers.

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P-26



AREA TYPE FLOW METER

Transmitter goes into 1, 2 or 4 inch pipe line like a valve and transmits flow measurements electrically to recorder in remote location.

Measures oil and other clear liquids under static pressures up to 600 psi. Minimum range 0 to 1200 lb. per hour, maximum range 0 to 9600 lb. per hour.

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*Process
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Life ...on the



AEROTIL® SOIL CONDITIONER COMBATS EROSION AND CRUSTING OF SOILS. Cyanamid's newest contribution to agriculture is a direct result of its early research work on acrylonitrile, which Cyanamid alone produces commercially. In two formulations for garden or large scale farm use, AEROTIL, the hydrolyzed polyacrylonitrile soil conditioner, helps to aerate soils, increases absorption and retention of moisture.

*Trade-mark



SITE OF CYANAMID'S NEW NITROGEN CHEMICALS PLANT on the Mississippi River near New Orleans where construction work is now in progress. This plant's initial products will be ammonia, acetylene, hydrocyanic acid and acrylonitrile, all produced from natural gas. Eventually, the plant will produce a wide range of nitrogen chemicals for industrial and agricultural use. Design and construction management are by Chemical Construction Corporation, a Cyanamid subsidiary.

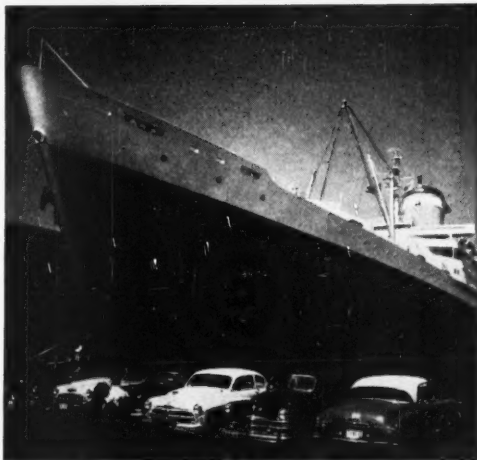


NEW FUEL AND WATER TANKS OF LAMINAC® RESIN reinforced with Fiberglass mat are now in service on trucks of Arabian American Oil Company. Aramco found that desert sandstorms ripped paint off conventional steel tanks which corroded rapidly in night dampness. Lightweight, reinforced LAMINAC tanks are stronger than steel, corrosion-resistant, and can be made larger than steel tanks of an equal weight, increasing Aramco's payloads.

Chemical Newsfront



WHITER WHITE-WALL TIRES USE UNITANE®, Cyanamid's titanium dioxide pigment, whitest pigment known. Versatile UNITANE pigments add brilliant whiteness, superior hiding power, and durability. In exterior architectural paints, the UNITANE titanium dioxide pigments impart self-cleansing to whites and permanence of tint to colors. In interior finishes, after-yellowing is reduced to a minimum. In baked product finishes, outstanding durability is assured by choice of the proper UNITANE pigment. In the several anatase and rutile types, UNITANE has many uses in the rubber, plastics, textile, paint, paper and cosmetics fields—has interesting possibilities in a host of others.



S.S. UNITED STATES IS MOST FIRE-RESISTANT PASSENGER VESSEL AFLOAT. The new queen of the seas is constructed almost entirely of non-combustible materials. Her fabrics—thousands of yards of drapes, bed spreads, and furniture covers have been made flame-resistant with PYROSET® Finish. This resin-based product is impregnated into fabrics to render them resistant to flame. PYROSET treatment does not interfere with hand or feel of fabrics, and will stand up to twenty-five dry cleanings without losing effectiveness.

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Please send a copy of the Third Edition of your catalog, "Products and Services of American Cyanamid Company for Industry and Agriculture."

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Company.....

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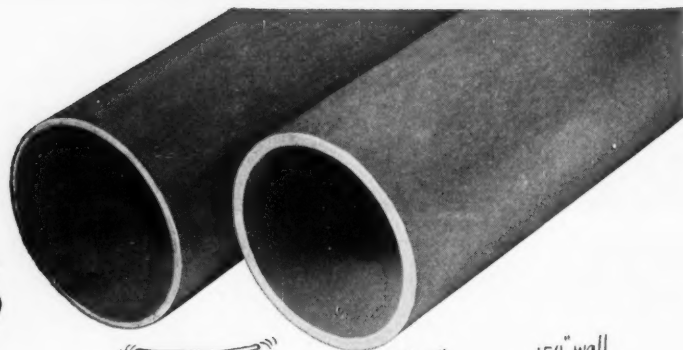
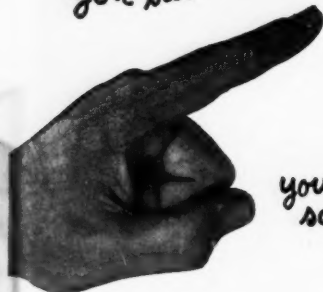
In Canada: North American Cyanamid Limited,
Toronto and Montreal

AMERICAN Cyanamid COMPANY

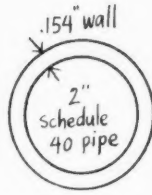
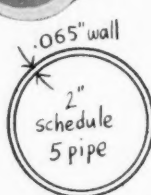
30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.



you save money



you save time and labor



you get greater flow and capacity

when you specify light wall schedule 5 pipe

WHAT SCHEDULE 5 PIPE IS—

A light wall pipe, Carpenter Schedule 5 gives you more feet of pipe for every pound of scarce stainless steel. So you can quickly see how Schedule 5 reduces your cost per foot. Plus the fact that the larger I.D. means increased flow area.

HOW SCHEDULE 5 REDUCES COSTS

First saving is 40% to 50% on the cost of your pipe.

Since Schedule 5 is considerably lighter, this means quicker and easier installation.

And, because the increased capacity of Schedule 5 lets you use the next smaller pipe size, you can reduce substantially your costs of valves, fittings, etc.

FITTINGS ARE AVAILABLE

This pipe is easily adapted to use with existing lines

of tubing or Schedule 40 and 10 pipe, using simple connectors. Fittings as well as stocks of Schedule 5 pipe are carried by conveniently located Carpenter distributors.

ADDITIONAL ADVANTAGES

Tubing sizes can now be replaced with light wall pipe...for ready hook-up with standard valves, pumps and other equipment which is normally manufactured in pipe sizes.



Data Sheets give you complete information about Carpenter Schedule 5 Stainless Pipe. Write for your personal copy. THE CARPENTER STEEL COMPANY, Alloy Tube Division, Union, N. J.

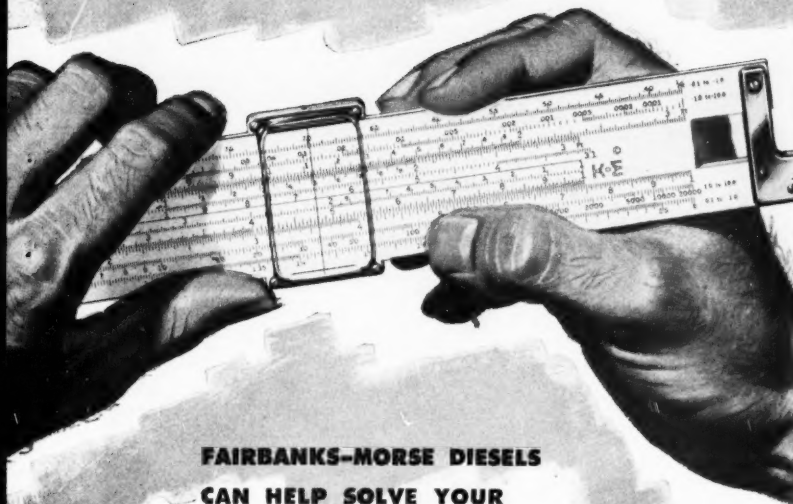
Export Dept.: The Carpenter Steel Co., Port Washington, N.Y. "CARSTEELCO"

Carpenter

STAINLESS TUBING & PIPE



- guaranteed on every shipment



**FAIRBANKS-MORSE DIESELS
CAN HELP SOLVE YOUR**

Power Equation

Balancing the many elements of power requirements—against cost—is a major problem facing all manufacturers today. Failure to solve this complex equation can mean the difference between profit and loss.

But, is there a solution in Your Plant?

Look at this partial list of Fairbanks-Morse Diesel advantages and see. F-M in-plant power economically adds to current capacity as load increases . . . eliminates purchasing power at rates based on high peak demand values. Improved power factor. Better current characteristics. Flexibility. Economy. These are a few of the factors that can put your power equation in balance.

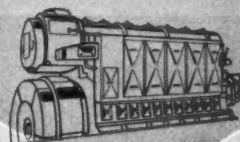
If you want the answer to your power equation, write us today outlining your needs. Fairbanks-Morse engineering can give you a proved answer . . . based on over 50 years' experience in industrial and municipal power generation. Fairbanks, Morse & Co., Chicago 5, Ill.



FAIRBANKS-MORSE

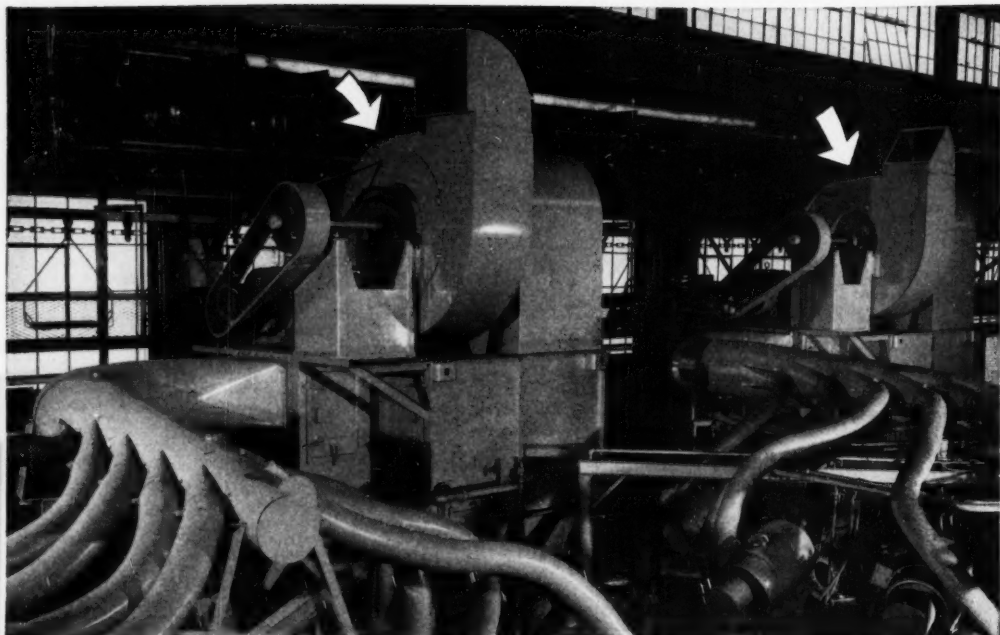
a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • ELECTRICAL
MACHINERY • PUMPS • SCALES • RAIL CARS • MAGNETOS • FARM MACHINERY



Put Your Power Costs and Performance in Order

- 1 **Handle Peak Demand** . . . reduce peak demand values for lower purchased power cost.
- 2 **Raise Power Factor** . . . "in-plant" generator can eliminate power factor penalties.
- 3 **Emergency Power** . . . insurance against lost production, damage due to line failures.
- 4 **Handle Surge Loads** . . . that may now be affecting current characteristics of entire plant.
- 5 **Plant Expansion** . . . need not be restricted due to lack—or expense—of ample power.
- 6 **Useful Heat** . . . lube oil, water and exhaust heat can cut drying and heating costs.
- 7 **Chemical Value** . . . exhaust gases are high in nitrogen—available for economical fixation of nitrates, ammonia.
- 8 **Insurance Advantage** . . . of diesel over gasoline engine, for example, will soon pay for installation.
- 9 **No Weather Worries** . . . ice, snow, sleet, wind storms can't stop plant operations.
- 10 **Handle Increasing Load** . . . "in-plant" power economically adds to current capacity as load increases.
- 11 **Fuel Economy** . . . use diesel oil, natural gas or sewage gas for added economy.
- 12 **Remote Locations** . . . distance from transmission lines needn't curtail planned plant expansions.
- 13 **Compact Power** . . . Fairbanks-Morse engines give you more power per foot of floor space, more power on present foundation.
- 14 **Minimum Attendance** . . . Fairbanks-Morse "in-plant" generating sets require minimum supervision and maintenance.
- 15 **Save Cost** . . . of running in new line where present transformers and power lines are already loaded.



Another Clarage Installation in One of America's 97* Largest Industrial Enterprises

***97**
OF AMERICA'S
100 LARGEST
CORPORATIONS

are users of Clarage equipment . . . This wide acceptance denotes the high quality and reliable performance of Clarage products.

Above you see two of the twelve Clarage Improved Exhausters on a vital-to-production dust collecting job in the Monroe, Michigan plant of the Ford Motor Company.

These twelve fans operate in connection with twelve American Air Filter Company's Roto-Clone installations.

Ford Motor Company has used Clarage equipment for over a quarter century.

Counting all of this Company's plants, well over a thousand Clarage fans are now handling the many and varied air handling requirements of this leading automotive and defense materiel manufacturer.

You can **RELY** on Clarage equipment to give you economical service for a long time to come. **CLARAGE FAN COMPANY.**
637 Porter Street, Kalamazoo, Michigan

You can Rely on...

CLARAGE

Headquarters for
Air Handling and
Conditioning Equipment



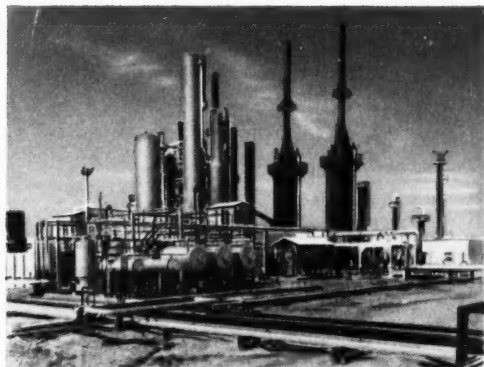
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA Canada Fans, Ltd., 4285 Richelieu St., Montreal



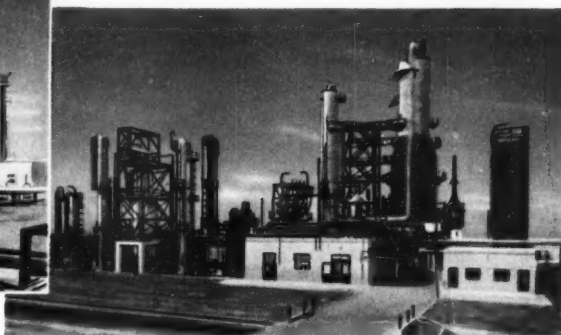
20,000 barrels per day of Alberta Crude oil are processed in the units of Canadian Oil Refineries' Sarnia, Ontario, plant on the St. Clair River

HIGH OCTANE FOR **Canada**

The design and construction of the new Sarnia refinery of Canadian Oil Refineries Limited were managed by Stone & Webster Canada Limited utilizing the facilities of Stone & Webster Engineering Corporation. It is the first fully integrated refinery in Canada entirely employing the latest processes for producing maximum yields of high octane gasoline. The project includes special equipment to prevent pollution of the river.



Crude Distillation Unit



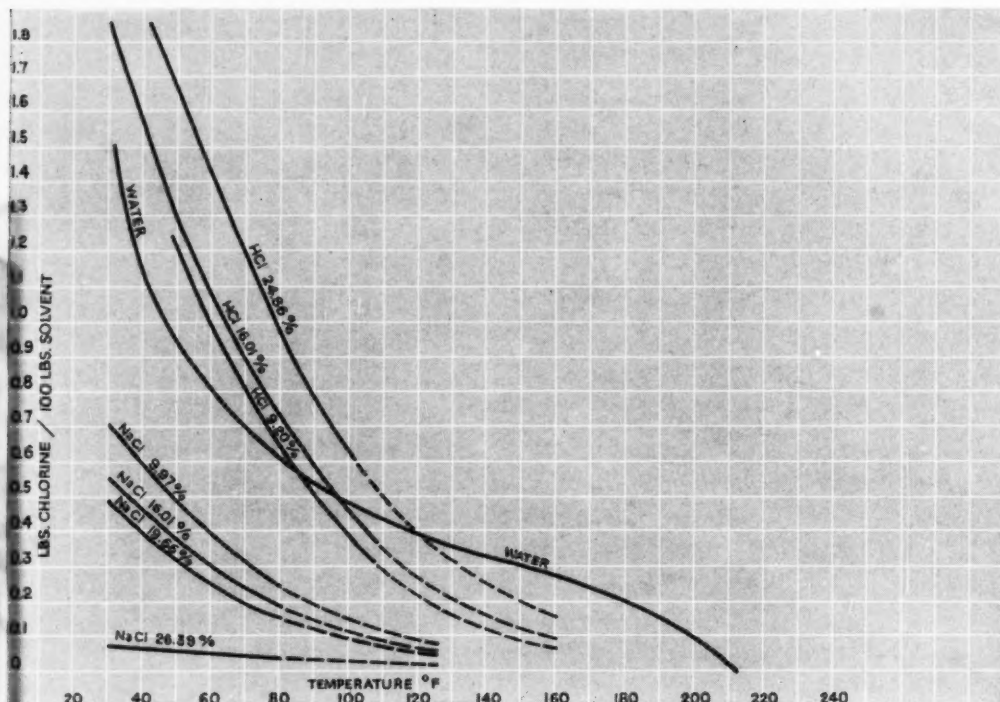
Catalytic Cracking Unit

STONE & WEBSTER ENGINEERING CORPORATION

Affiliated with

STONE & WEBSTER CANADA LIMITED
E. B. BADGER & SONS (Great Britain) LTD.

Chemicals you live by



CHLORINE . . . solubility in water and other solvents

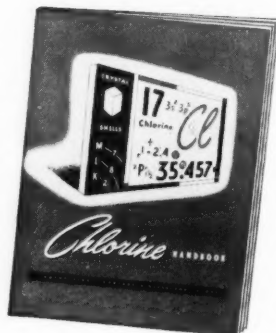
The solubility of chlorine gas, as found in the literature, is usually given in terms of the absorption coefficient. The solubility curves shown in this chart have been prepared using the more practical weight units. The solubility of chlorine is shown for water, salt solutions and hydrochloric acid solutions as the solvents.

Chlorine forms with water a hydrate $\text{Cl}_2 \cdot 8\text{H}_2\text{O}$ at temperatures below 9.6°C . at atmospheric pressure. The system Cl_2 and H_2O is claimed to have two invariant points, one at 0.24°C . and 244

mm Hg pressure, and the other at 28.7°C . and 6 atmospheres pressure.

Chlorine is appreciably soluble in a number of organic solvents, particularly at low temperatures. As examples of this phenomenon, Taylor and Hildebrand give the following data: A saturated solution of chlorine in heptane at 0°C . contained 20.36% chlorine by weight. A saturated solution of chlorine in carbon tetrachloride at 0°C ., 19°C ., and 40°C . contained 15.6%, 8.48%, and 4.33% chlorine by weight, respectively.

This is a section from our Chlorine Handbook, written for those who are concerned with the applications of chlorine. 43 pages, charts, bibliography. A copy is yours free for the asking.



Chemicals you live by ... **DIAMOND ALKALI COMPANY** CLEVELAND, OHIO

SODA ASH • CAUSTIC SODA • CHLORINE & DERIVATIVES • BICARBONATE OF SODA • SILICATES • CALCIUM COMPOUNDS • CHROME COMPOUNDS • ALKALI SPECIALTIES • ORGANICS



Life-Lines are pre-lubricated . . . need no further lubrication. Write for "Facts on Pre-lubricated Bearings" B-4378. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.
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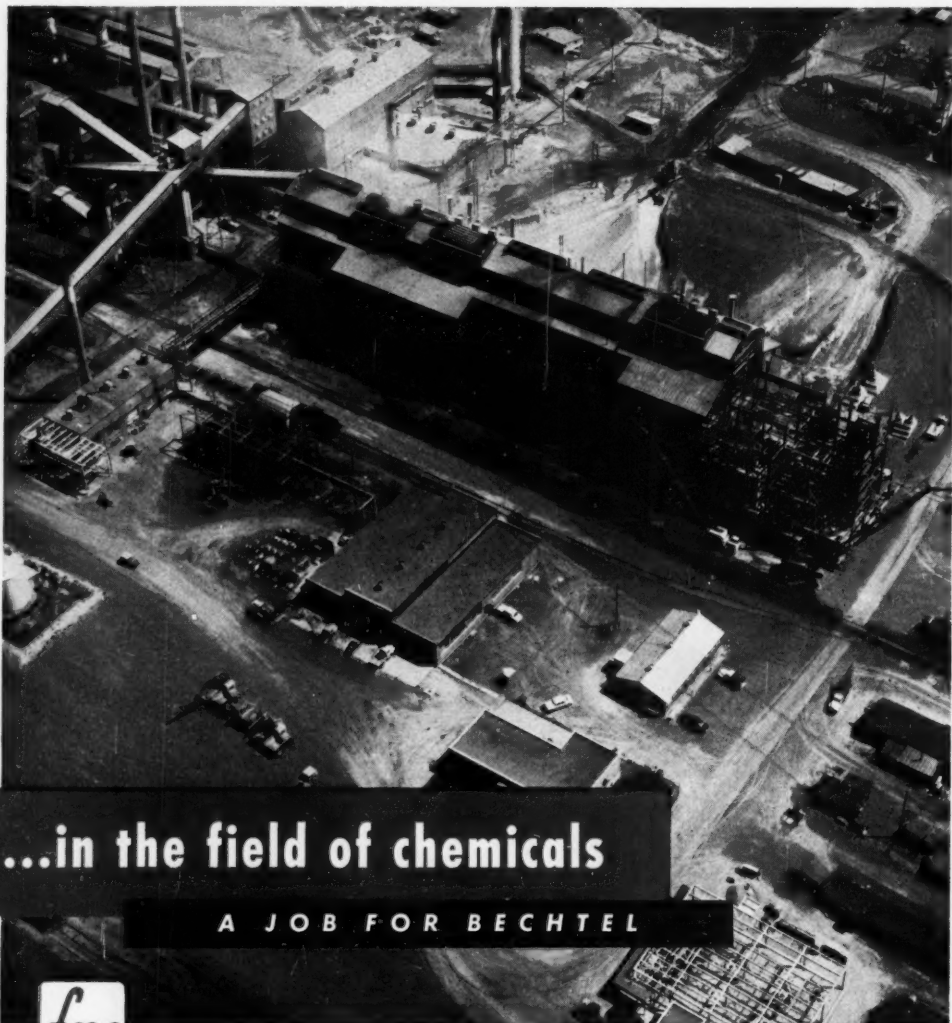
WHAT *Life-Lines* REALLY DELIVER
IS MORE SERVICE...LESS SERVICING



YOU CAN BE SURE...IF IT'S
Westinghouse

Life-Line

MOTORS and CONTROLS



...in the field of chemicals

A JOB FOR BECHTEL



Characteristic of the forward-looking policies that activate Food Machinery and Chemical Corporation is the major expansion program currently under way by its Westvaco Chemical Division. Projects include new facilities at four locations for production of phosphorus, phosphates, soda ash and nitric acid.

Engineering and construction of all four are by Bechtel Corporation—an organization providing knowledge, skills and experience necessary to translate a management decision into an operating plant promptly.

Westvaco phosphorus plant at Pocatello, Idaho, where comprehensive additions are nearing completion.



BECHTEL CORPORATION

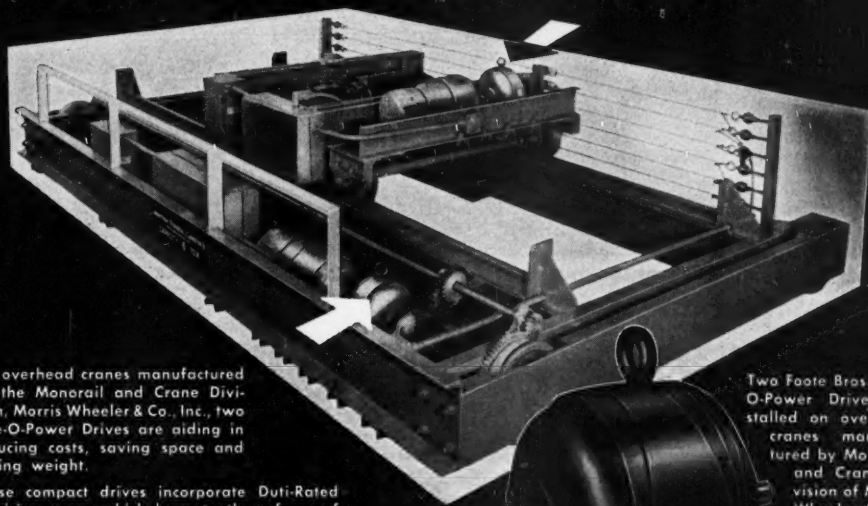
Los Angeles • SAN FRANCISCO • New York

HOW MORRIS, WHEELER & CO., INC.

CUT : CUT Original Cost : Operating Cost

SAVED SPACE • SAVED WEIGHT

with FOOTE BROS. Line-O-Power Drives



On overhead cranes manufactured by the Monorail and Crane Division, Morris Wheeler & Co., Inc., two Line-O-Power Drives are aiding in reducing costs, saving space and saving weight.

These compact drives incorporate Duti-Rated precision gears which have tooth surfaces of high hardness with tough ductile cores assuring years of wear-life even under tough service.

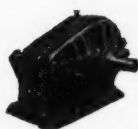
You will find these drives ideal for use in your plant or on the equipment you manufacture.

Efficiency 96% or higher. Capacities from 1 to 175 h.p. Ratios 5 to 1 up to 238 to 1.

Two Foote Bros. Line-O-Power Drives installed on overhead cranes manufactured by Monorail and Crane Division of Morris Wheeler & Co., Inc., Philadelphia.

FOOTE BROS.

Better Power Transmission Through Better Gears



Maxi-Power Drives



Hygrade Drives



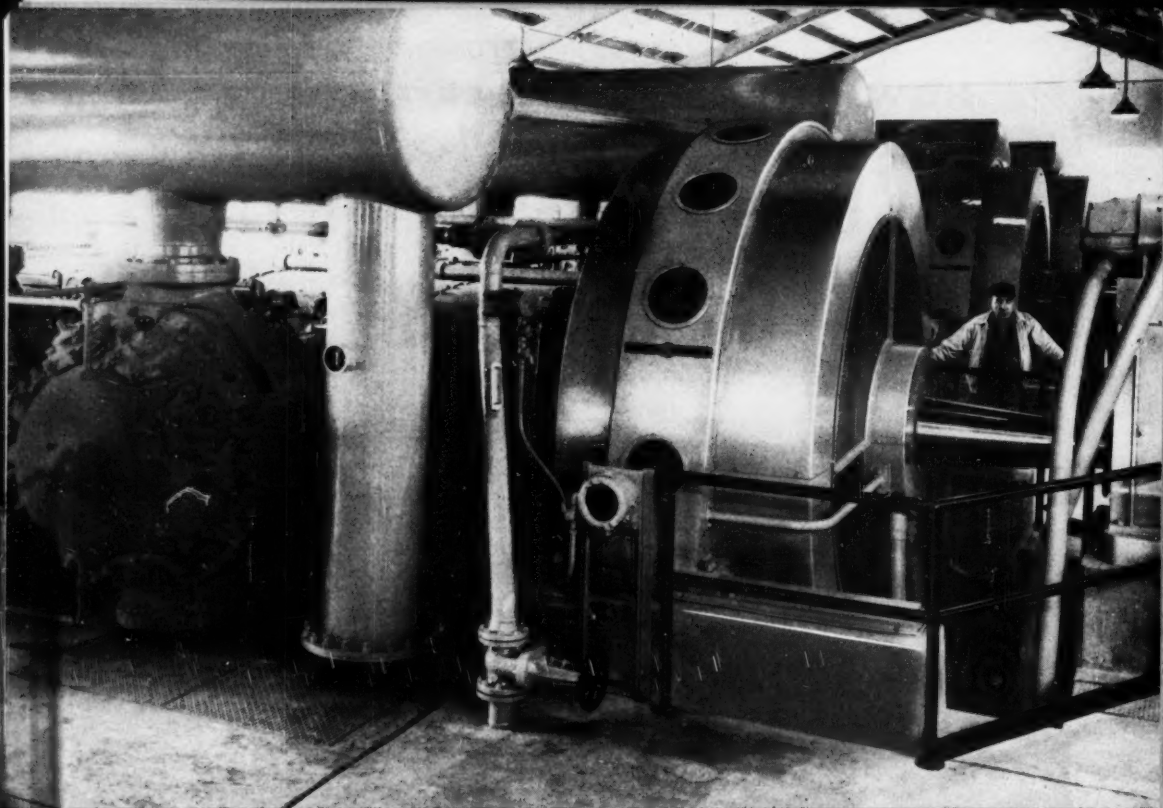
Foote Bros.-Louis Allis Gearmotors

Foote Bros. Gear and Machine Corporation
Dept. CE, 4545 South Western Boulevard
Chicago 9, Illinois

Please send me a copy of Bulletin LPB on
Foote Bros. Line-O-Power Drives.

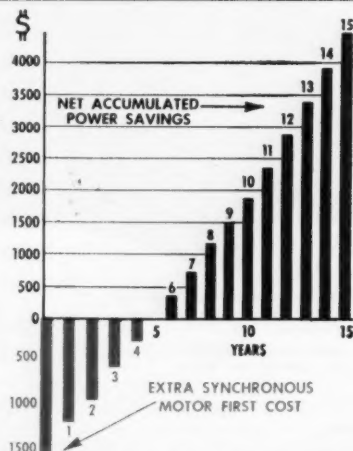
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Company.....
Position.....
Address.....
City..... Zone..... State.....





COMPRESSORS IN A GAS STORAGE STATION are driven by General Electric 3000 hp, 300 rpm synchronous motors.

Can synchronous motors cut

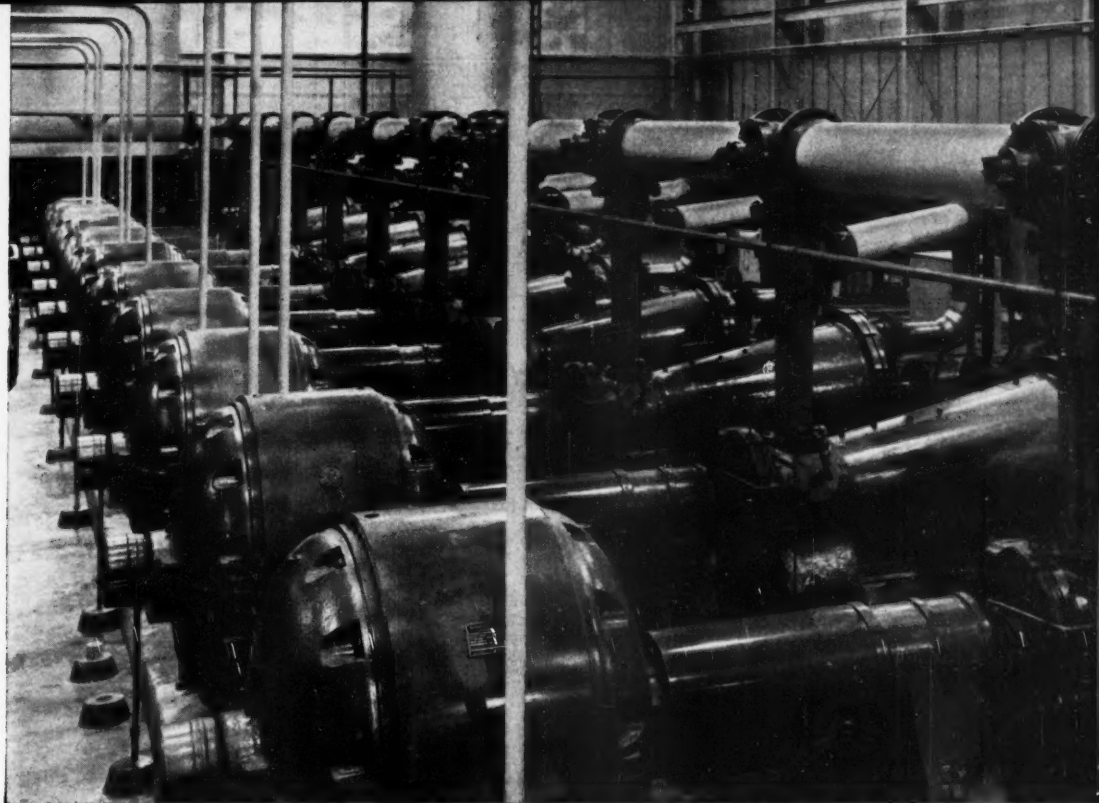


Here's how one plant saves with a G-E Synchronous Motor

The specifications for a new pump motor were 250 hp, 600 rpm, 2300 volts, 3 phase, 60 cycle. The price of a 1.0 Power Factor synchronous motor, including exciter and control, was higher than an equivalent squirrel-cage induction motor with control. However, the synchronous motor efficiency, including exciter loss, was 1.6% higher than the induction motor (93.0% vs 91.4%). Since the motor was to operate continuously at a power cost of 11 mills per kilowatt-hour, it was found that the power savings would repay the additional investment in only five years. The operating savings will continue throughout the life of the motor—10, 20, even 30 years.

Savings such as these make synchronous motors the most economical drive for many heavy-duty, continuous-service applications. And in many cases, synchronous motors are lowest in first cost, too.

OPERATING SAVINGS on the synchronous motor application described above are shown over a period of twenty years. Extra first cost will be amortized in five years; savings will continue for many more.



GENERAL ELECTRIC 400 HP SYNCHRONOUS MOTORS are coupled to ten Jordans in a paper mill.

your plant's operating costs?

Greater Efficiency on Large, Constant-Speed Applications Can Lower Power Costs Substantially

On certain applications selection of General Electric synchronous motors can bring about substantial savings in plant operating costs. Synchronous motors usually have a higher full-load efficiency than any other type of motor, produce more work per dollar's worth of power consumed.

Furthermore, synchronous motors may be able to improve plant power factor—the ratio of total kilowatt load to total kva load. When these two fall out of balance, high system losses, high power bills, or increased maintenance costs commonly result. Using a *unity power factor* synchronous motor adds only to total kw load. And, a *leading power factor* synchronous motor will actually supply reactive kva's to your

system, while operating at its normal rated output.

Before you select a drive for a large piece of equipment providing heavy and continuous service, be sure to investigate the economics of General Electric synchronous motors. Call in your G-E representative—he'll be glad to discuss your situation with you. Also, information on G-E synchronous motors and their application is available in the following bulletins: GEA-5332, "Low-Speed Synchronous Motors;" GEA-5426, "High-Speed Synchronous Motors;" GEA-5817, "Plant Power Factor Improved With G-E Synchronous Motors." Write to Section 770-27, General Electric Company, Schenectady 5, N. Y.

GENERAL  ELECTRIC

how to chelate

(pronounced "Key late")



.... Versene*

VERSENE* CHELATES CATIONS

Before you can chelate foreign metallic ions in solutions you must have a powerful chelating agent such as Versene. This is a compound that will inactivate cations with the formation of inner ring structures in the molecule. It makes the metallic ion become part of the rings. This is a valuable thing to know because it will prevent all kinds of contamination caused by cations.

PREFERENTIAL CHELATION

When Versene is added to a mixture of various metallic ions chelation will be preferential. That is, one metal will be complexed before another. When the first is exhausted the second will be inactivated and the process will go on until either metallic ions or Versene are used up. Page 7 of Section I of Bersworth's Technical Bulletin No. 2 gives a table which shows the order of chelation of some of the common metals at various pH's. Send for it.

VERSENES* — POWERFUL CHELATING AGENTS

The Versenes, made only by the Bersworth Chemical Company under processes originated, developed and patented by F. C. Bersworth, are the most powerful chelating agents known. They are exceptionally stable at high temperatures and all pH's. Quality standards of manufacture are so high that uniform complexing power is guaranteed for *either* sample or carload quantities. Ask for Technical Bulletin #2. Write Dept. B for samples. Chemical counsel available.

VERSENE* WATER TEST KIT. Tells Total Hardness in 2 minutes. Accurate to 1 grain per gal. Versenate method. Complete with instructions \$5.00 Postpaid.

*Trade Mark Registered



*'Chemistry's most
precise chemicals'*



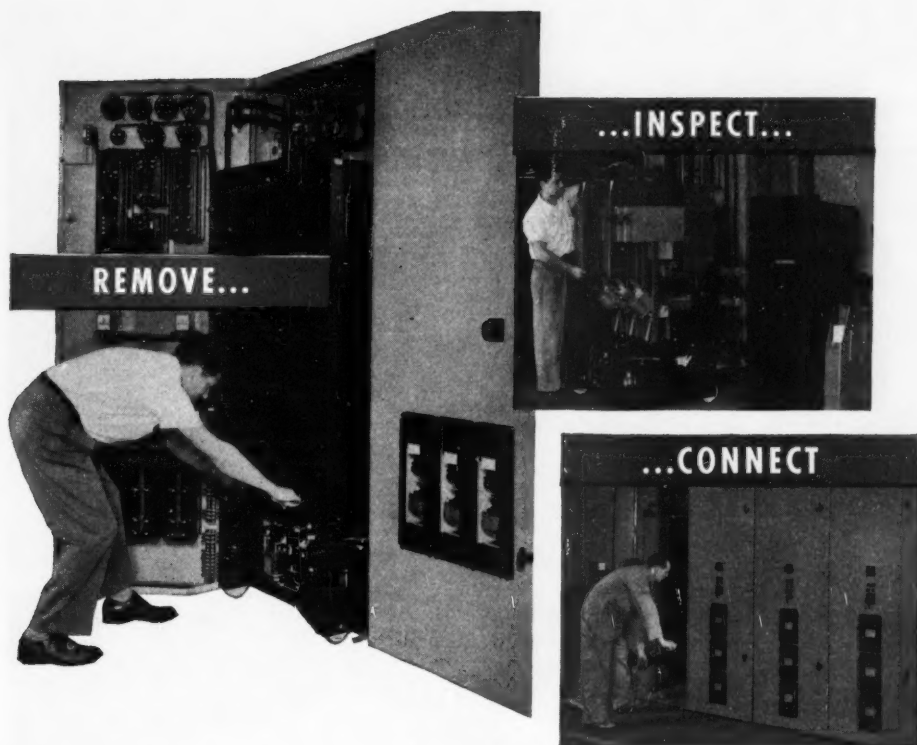
BERSWORTH CHEMICAL COMPANY
FRAMINGHAM, MASSACHUSETTS

Warehouse Stocks:

George Mann — Providence, R. I.
Griffin Chemical Co. — San Francisco — Los Angeles
Siegel Chemical Co. — Brooklyn, N. Y.
Barada & Page, Inc. — Dallas — Houston — New Orleans — Oklahoma City — St. Louis — Tulsa — Wichita

Wasatch Chemical Co. — Salt Lake City
Kraft Chemical Co. — Chicago
C. S. Tanner Co. — Charlotte, N. C.

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It's easier, faster, safer with Westinghouse horizontal drawout switchgear!

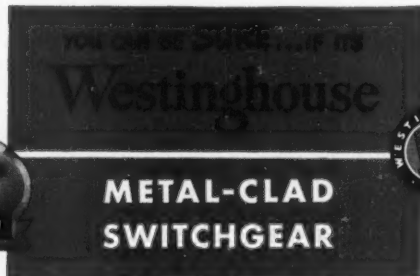
You can remove breakers, inspect them, and replace them in only a few minutes when you use Westinghouse Type DH Metal-Clad Switchgear. Because breakers are drawn out horizontally, no lowering or lifting is necessary. A shutter indicator, visible from the front, provides positive indication of disconnect position. As the breaker is withdrawn, a grounded metal shutter closes to isolate stationary contacts.

When the breaker is removed, interphase barrier and arc chutes remove easily to expose contacts at an accessible and convenient working height for quick inspection.

Replacing the breaker is just as easy and safe. A few easy turns of a crank move the breaker from dis-

connect to operating position. A mechanical interlock positively prevents engagement of crank linkage unless the breaker is open.

For complete information on Westinghouse Metal-Clad Switchgear for indoor or outdoor service write for Booklet B-5306. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-60792





SPECIAL STAINLESS STEEL INNER WIRE BRAID IS SECURELY LOCKED TO INSIDE WALL OF TUBE. You get this added safety protection and assurance of longer hose life only with **CONCORD #20 STEAM HOSE**...another of BWH's significant developments in the field of mechanical rubber products!

Resists Tube Swelling

Withstands Tough Usage

Concord #20 STEAM HOSE

Here's the steam hose with built-in long life... in the form of a special stainless steel inner wire braid.

This inner lining is there to fight tube swelling under continuous high pressure... a condition that kills ordinary steam hose — and usually kills it *fast*.

Found only in **CONCORD #20 STEAM HOSE**, this protection helps assure retention of original inside hose diameter... acts against swelling and constriction of tube... promotes full flow of steam and easy recoupling in the field when necessary.

CONCORD #20 includes other construction features: two or three braids (depending on size) of alternate high tensile steel wire and rubber layers firmly bonded over outside of tube for maximum burst protection and safety; an asbestos braid for positive cover adhesion and cover insulation; a rugged, abrasion-resistant cover that withstands the toughest abuse.

Put **CONCORD #20** to work for you now... get in touch with your nearby BWH distributor today.



Another Quality Product of

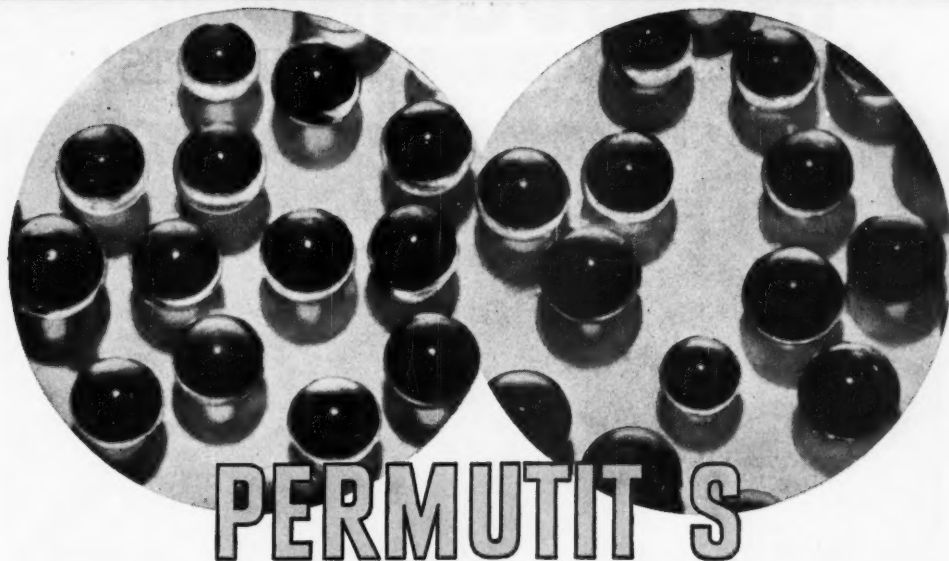
BOSTON WOVEN HOSE & RUBBER COMPANY

Warehouse Stock: 111 N. Canal St., Chicago, Illinois

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U.S.A.

YOU ARE LOOKING AT



PERMUTIT S

A highly basic Anion Exchange Resin with a high reaction rate

● Permutit S is a highly basic quaternary amine anion exchange resin . . . has the ability to remove anions of weakly ionized acids such as carbonic and silicic, as well as strongly ionized acids such as sulfuric and hydrochloric.

In producing boiler feedwater equivalent to distilled water (at only a small fraction of the cost of distillation), Permutit S following a hydrogen exchanger simultaneously removes silicic, carbonic, sulfuric and hydrochloric acids.

Other applications suggesting the versatility of Permutit S include:

Purification—residual sulfate removal in vitamin manufacture; Recovery—metals from industrial waste waters; Concentration—to eliminate numerous extraction and precipitation steps in the manufacture of alkaloids such as quinine, scopolamine, atropine, nicotine.

Permutit's research files contain a wealth of available information on many other applications . . . can save you valuable time that might be wasted in needless duplication of extensive tests.

For over 40 years, Permutit has been developing and producing ion

exchange materials of all types to meet the highest specifications. Quality controls . . . in setting up each production run, exhaustive sampling and constant supervision during manufacture, plus complete testing of each batch before release for sale . . . assure a reliably uniform product that equals or exceeds ratings.

Remember, Permutit is the sole manufacturer of all types of ion exchange materials as well as equipment . . . therefore a source that can be relied on for unbiased recommendations for solving any type of water conditioning problem.

SEND FOR SAMPLE RESINS

Cation Exchangers: Permutit Q, Zeo-Dur,® Zeo-Karb,® Permutit H-70 • Anion Exchangers: De-Acidite® and, of course, Permutit S

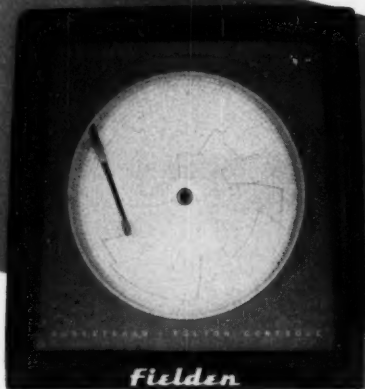
PERMUTIT

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS

INTRODUCING...

3 NEW ELECTRONIC INSTRUMENTS!

Simple • Accurate • Low Cost

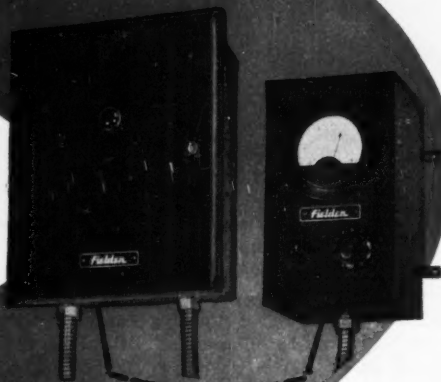


Fielden Series 40 Recorder

— a unique electrical quantity recorder. A simple electrical meter, with a light-weight vane in place of the customary pointer, replaces the usual complicated circuitry and mechanisms. A servo-motor positions a follower vane, maintaining a fixed spacing with respect to the meter vane—and at the same time driving the pen. E.S.D. 50 microamps, 15 millivolts or higher. 1% accuracy—remarkably low cost.

Fielden Electronic Level Indicator

— new, modern solution to accurate, continuous level measurement without mechanical or pneumatic means. For liquids, viscous fluids or granular solids in tanks or bins. Actuated by change in capacitance between an insulated electrode and the sides of the container. When material is stored, the degree of immersion of the electrode is indicated at remote or local station.



Fielden Tektor

— capacity actuated, high or low level, fixed point control or alarm system. For liquids, granular or free-flowing solids, conductors or non-conductors. Rod or disk electrode, insulated or bare metal. Answers many difficult level control problems involving high pressure, temperature or extremely corrosive conditions.

These new instruments can help simplify operations and solve troublesome problems in many industries—at low cost. Consult us about your applications or problems. For information, write Dept. TC, Fielden Instrument Division, Robertshaw-Fulton Controls Co., 2920 North 4th Street, Philadelphia 33, Pennsylvania.

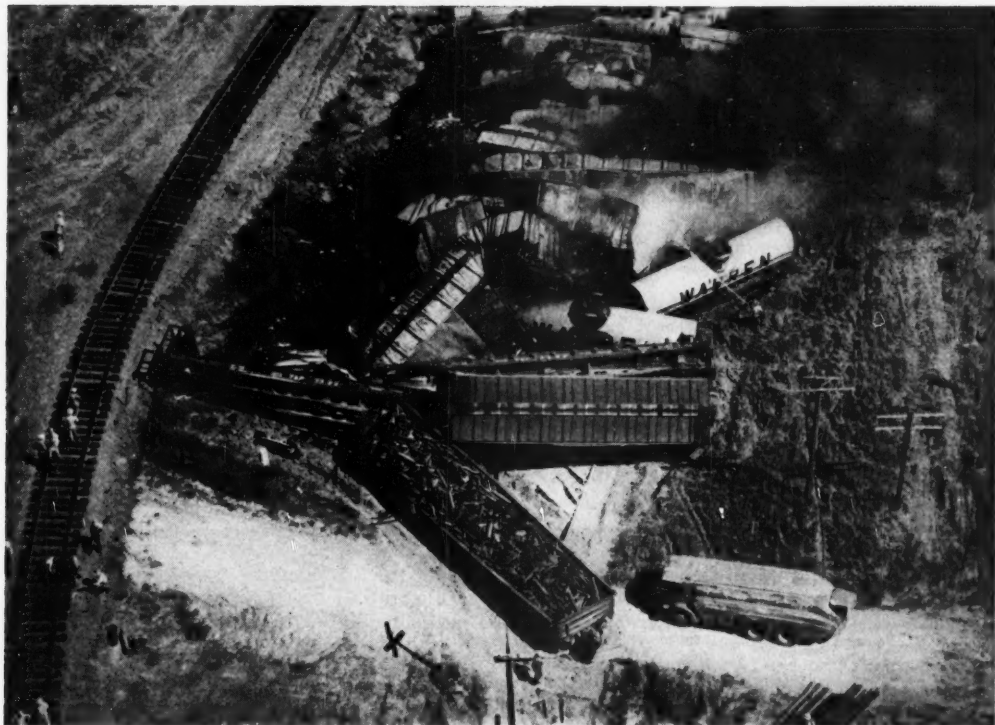
Fielden

INSTRUMENT DIVISION

ROBERTSHAW-FULTON CONTROLS CO.

2920 North 4th Street • Philadelphia 33, Pa.

"PILE OF TIN CANS AND ORANGE CRATES" ...said a newsman at the scene.



YET—THE TANK CARS CAME THROUGH!

At Corsicana, Texas on May 10, 1952, 35 cars of a 62 car-train were derailed. Luckily, none of the five crewmen was injured in this accident which included two Q.C.F. built, Warren Petroleum cars. Not a drop of a lading was lost due to the wreck —attesting to the sound construction of Q.C.F. double-welded cars.

No, it was not just luck that from this mangled wreckage Q.C.F. cars came through. The Warren Petroleum Company said later, "...the type of construction of this class of equipment speaks for itself."

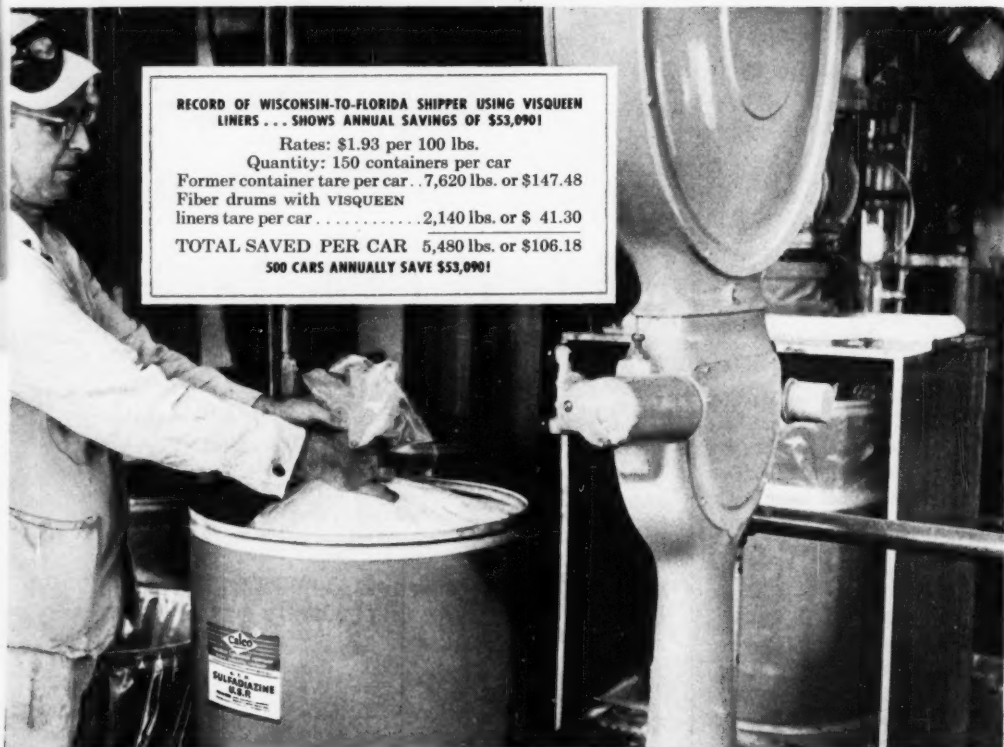
And so it goes. Shippers everywhere are finding out what it means to ship in an Q.C.F. built car. To find out the many advantages of Q.C.F. All-Welded Tank Cars, write American Car and Foundry Company, 30 Church Street, New York, New York. Sales Offices in: Chicago • St. Louis • Washington • Cleveland • Philadelphia • San Francisco.

Q.C.F. **ALL-WELDED**
TANK CARS
for Safe Delivery—

just what the doctor ordered
for cutting sulfa shipping costs...

VIS

IMPORTANT! VISQUEEN film is all polyethylene, but not all polyethylene is VISQUEEN. VISQUEEN is the only film produced by process of U. S. Patent No. 2461975. Only VISQUEEN has the benefit of research and technical experience of The Visking Corporation, pioneers in the development of pure polyethylene film.



RECORD OF WISCONSIN-TO-FLORIDA SHIPPER USING VISQUEEN LINERS . . . SHOWS ANNUAL SAVINGS OF \$53,090!

Rates: \$1.93 per 100 lbs.
Quantity: 150 containers per car
Former container tare per car . . 7,620 lbs. or \$147.48
Fiber drums with VISQUEEN
liners tare per car 2,140 lbs. or \$ 41.30
TOTAL SAVED PER CAR 5,480 lbs. or \$106.18
500 CARS ANNUALLY SAVE \$53,090!

QUEEN*

shipping your product in *VisQueen**
can reduce tare weight up to 70%—assure 100% recovery!

Sulfa is a hygroscopic . . . picking up moisture like a magnet picks up iron. Ordinary heavy, bulky containers can't prevent it, or the resulting caking and lumping. These containers are costly to ship, often weighing far more than the product itself.

It was natural then that American Cyanamid Company, Calco Division, should turn to the proven economy and assured 100% product recovery of VISQUEEN film liners in fiber drums.

VISQUEEN locks out moisture. From shipping point to destination VISQUEEN prevents spoilage, contamination and leakage. VISQUEEN is a chemically inert moisture barrier, unaffected by acids or alkalis—odorless and tasteless. The consistent uniformity and strength of VISQUEEN film (which is unduplicated by any other film on the market) minimizes breakage.

VISQUEEN won't split, shatter, crack or run.

BEST OF ALL VISQUEEN SAVES MONEY . . . BIG MONEY

For example: a VISQUEEN liner and "boot" in a fiber drum is 50 to 75% lighter than alternative containers, successfully carrying 400 lbs. of liquids under all types of normal handling. Accidental falls and abuse which might shatter rigid containers leave VISQUEEN unaffected because of its high tensile strength and tear resistance.

VISQUEEN liners can be used for liquids (corrosive or not), semi-liquids or solids. Such use is approved by American Trucking Association. VISQUEEN and VISQUEEN converters work as a team to give you the better packaging that always spells economy. See a VISQUEEN converter.

*VisQueen** film

... a product of the **VISKING** corporation

World's largest producers of polyethylene sheeting and tubing

Preston Division, Terre Haute, Indiana

In Canada: Visking Limited, Lindsay, Ontario

*T. M. The Visking Corp.

THE VISKING CORPORATION, BOX 110-1410
Preston Division, Terre Haute, Indiana

Please send names of VISQUEEN converters in my area.

Name.....

Company.....

Address.....

City.....

Zone..... State.....

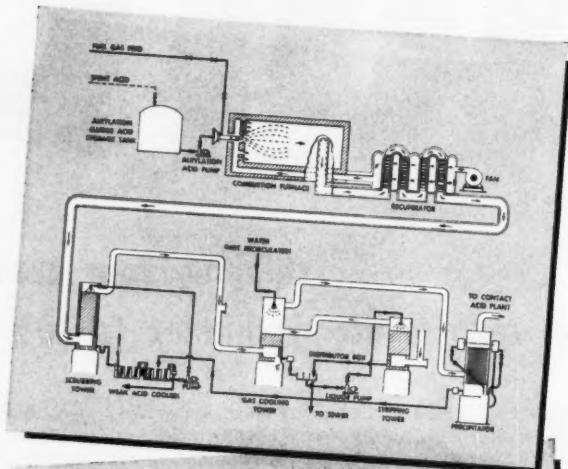
**Efficient, proved
Chemico processes for**

Waste Acid Recovery

from Spent Alkylation Acid

In this economical Chemico process, spent alkylation acid is sprayed into a furnace maintained at a high heat with auxiliary burners. Sulfur or hydrogen sulfide may be used as fuel thereby producing SO_2 gas for the production of make-up acid.

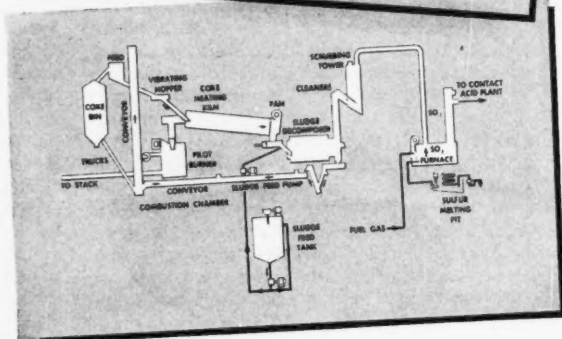
A limited amount of other liquid acid sludges, high in hydrocarbon content, may also be added to the spent alkylation acid, thus providing fuel as well as additional acid production. The hydrocarbons are completely consumed and the acid is broken down into its components—sulfur dioxide, oxygen and water. After the water is removed, the gas is processed to fresh acid of 98% strength in a standard Chemico contact sulfuric acid unit.



from Refinery Sludge

This proved and practical process offers three important advantages. (1) The purified SO_2 gas provides a product acid that is free of carbon contamination. (2) The resulting H_2SO_4 may be 98% or any higher strength regardless of the initial strength of the sludge. (3) Sludges that cannot be processed by other methods may be satisfactorily used in this system.

As shown in the diagram, unseparated acid sludge is continuously decomposed in a closed, fumeless system into a strong SO_2 gas and a dry granular coke of value as a byproduct fuel. After passing through a simple purification system, the SO_2 gas is converted into H_2SO_4 in a standard Chemico contact acid plant.



You can profitably produce much needed sulfuric acid, if you have either of these waste acids in commercial quantities. Chemico will design and construct the complete plant . . . deliver it in smooth-running operation on a performance-guaranteed basis. For specific recommendations, write us describing your problem fully.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

CABLES: CHEMICONST, NEW YORK

TECHNICAL REPRESENTATIVES: CYANAMID PRODUCTS LTD., LONDON • CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO • SOUTH AFRICAN CYANAMID (PTY) LTD., JOHANNESBURG

CC-241



*Chemico plants are
profitable investments*

*When you need NAPHTHA Solvents
with a consistently uniform high quality
and you must have a constant assured supply
... you'll find the perfect answer in*

ROOSEVELT

Naphthas

There is no room for uncertainty in modern manufacturing. You must have the right ingredients ... you must be sure of their consistent high quality ... and you must be sure of a constant supply. Because Roosevelt understands the manufacturer's problems, Roosevelt Naphtha Solvents have gained wide acceptance. Modern fractionating facilities which make possible complete catalytic sulphur removal mean non-corrosive, chemically stable solvents with an absolute minimum of offensive odors ... top grade quality! Ample reserves of the same crudes and constant quality control mean that every delivery of Roosevelt naphtha meets your specifications. Finally, Roosevelt Naphthas are delivered where and when you want them.

Roosevelt makes many standard Naphtha Solvents. If your needs are not standard we will make them to your specifications.

WRITE TODAY for
your copy of
Roosevelt's book
of specifications.
It's a worthwhile
addition to your
solvent file.



ROOSEVELT
oil and refining corp.
MT. PLEASANT, MICHIGAN

RECOVERED... 100,000 TONS OF DUST

100,000 tons of dust! That is the estimated four-year product recovery by Dracco Dust Control Equipment at an eastern lead smelting company.

This high-efficiency, complex system was Dracco-engineered to the customer's exact job requirements—collecting valuable end-product metal oxides. The multiple-unit installation filters 280,000 cubic feet of dust-laden air every minute and recovers an estimated 80 to 100 tons of product each day.

This outstanding installation of Dracco Dust Control Equipment is typical of "Performance Proved" applications in all types of industries.

Whether your problem is collecting valuable dusts or controlling harmful dusts or fumes, remember DRACCO—the Name, the Engineering Skill and the Dust Control System that will successfully solve your problem. Call in a Dracco Engineer—there is no obligation.

DRACCO CORPORATION

Harvard Ave. and E. 116th St. • Cleveland 5, Ohio

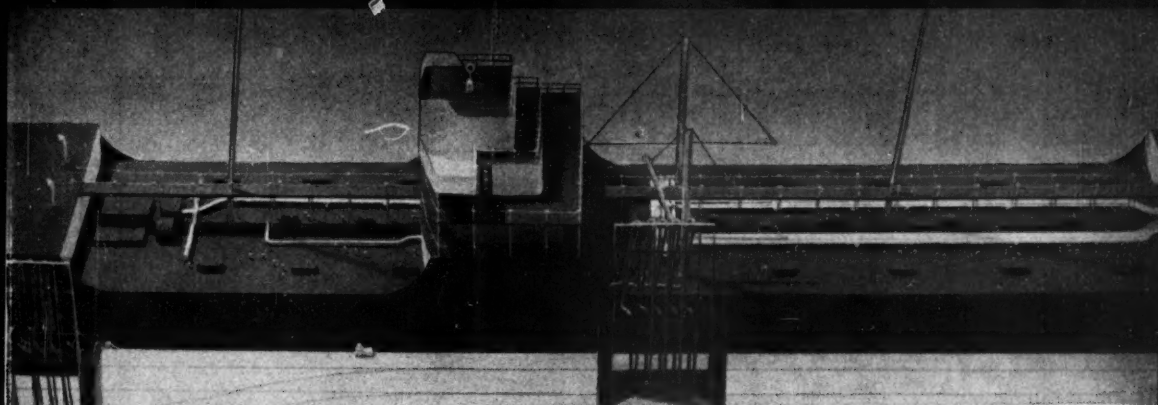


DRACCO

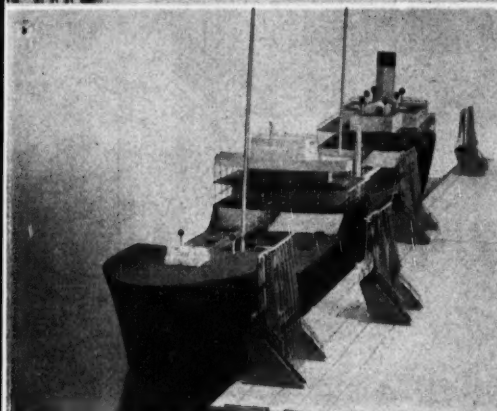
Airstream

CONVEYORS • DUST CONTROL EQUIPMENT

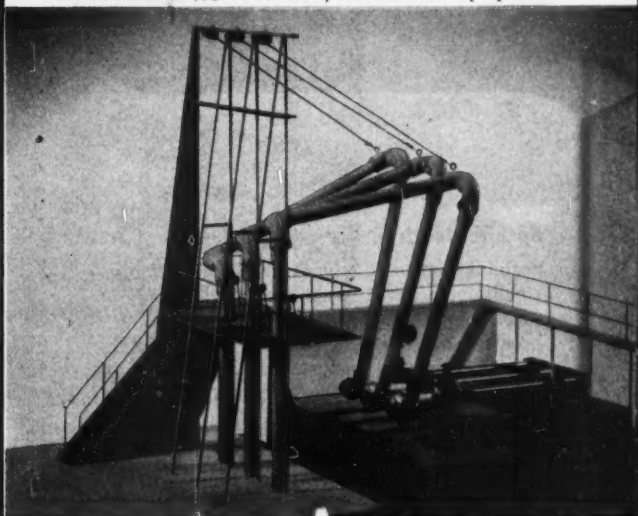
Performance Proved



Scale model tanker ($\frac{1}{8}$ " to 1') made for demonstration purposes.

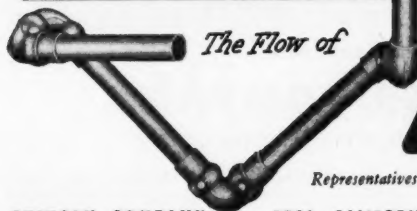


Loading racks provide multiple loading stations. Manifold lines under dock are easily connected to loading racks.



Larger model of a loading rack demonstrates flexibility of Chiksan aluminum marine and barge hose. Ship to shore connections can be easily handled by one man in a few minutes.

CHIKSAN



The Flow of

Enterprise Relies on

CHIKSAN

Ball-Bearing Swivel Joints



Representatives in Principal Cities • Write for Catalog 51-C, Dept. 10-CE

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 28, Illinois • Newark 2, New Jersey
Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Chiksan Export Company (Subsidiary), Brea, California • Newark 2, N.J.

BUY POLYOLS ON FACTS... Compare all four!

FACT

Sorbitol leads in versatility of uses

Sorbitol has special advantages for use in conditioning a wide range of products. And sorbitol often makes it possible to produce products which cannot be made with any other polyol. Sorbitol is used as a humectant in confections, cosmetics, dentifrices, glues, paper, tobacco, textiles.

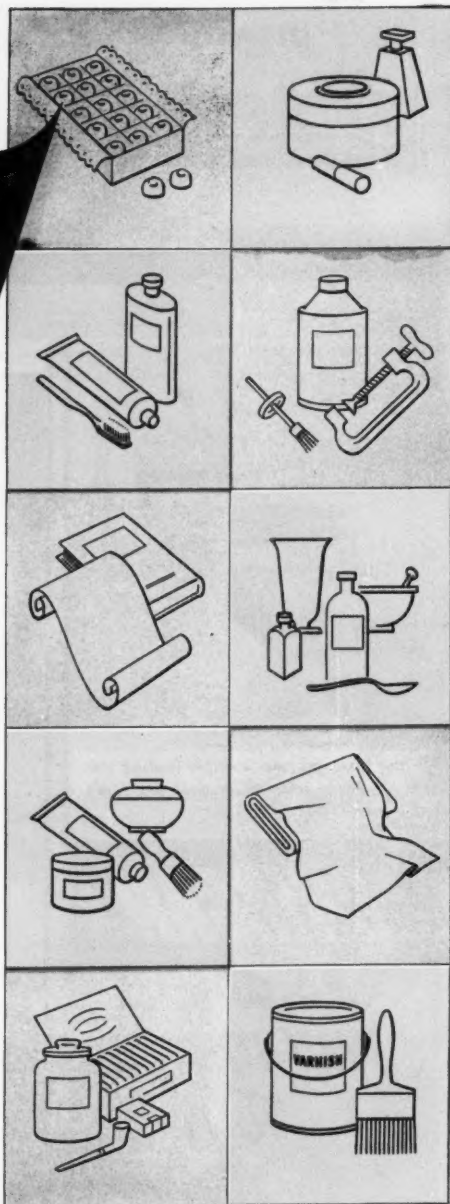
And sorbitol is also used in the synthesis of resins, surface active agents, vitamin C.

FACT

Sorbitol leads in economy and availability

On price stability alone, sorbitol rates the "best buy" in polyols. Through the years, its price trend has been downward. And, because sorbitol is made from sugar, it is available in almost unlimited quantities.

Write today for the valuable 22-page Atlas sorbitol book containing charts, usage tables, and other helpful data. Personal technical assistance is available at your request.



Industrial Chemicals Department

ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE • OFFICES IN PRINCIPAL CITIES

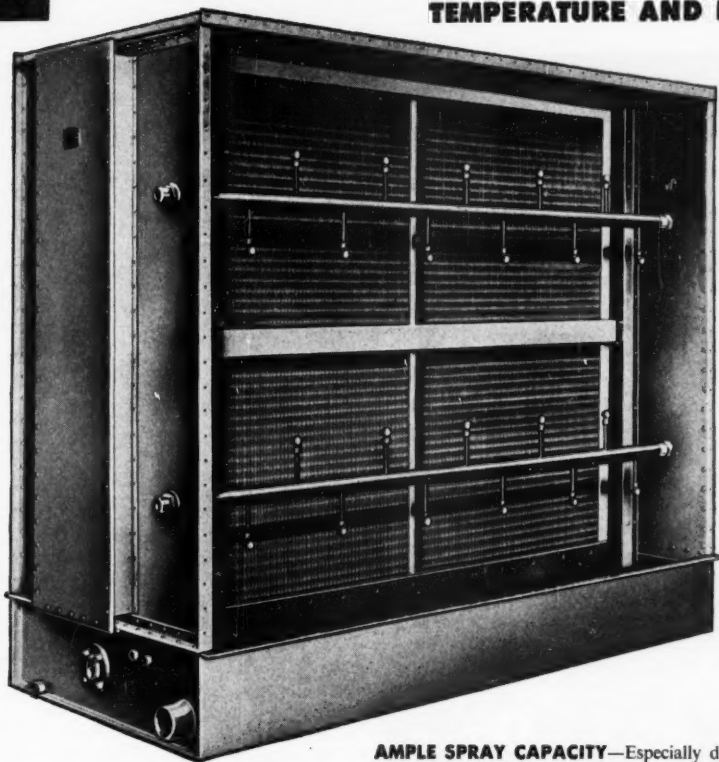
ATLAS POWDER COMPANY, CANADA, LTD., BRANTFORD, CANADA

ANOTHER
STURTEVANT
DEVELOPMENT!

NEW SURFACE DEHUMIDIFIER

(SPRAYED COIL)

FOR CLOSE CONTROL OF
TEMPERATURE AND HUMIDITY



This improved Surface Dehumidifier combines the effects of surface cooling and evaporative cooling. It offers the added advantages of keeping the coil surface free from foreign matter and odors by continually spraying and washing them down.

EXCLUSIVE STURTEVANT FEATURES

BALANCED AIR FLOW—Moisture eliminators direct the leaving air in *two divergent streams*. This minimizes air spin and insures rated fan performance.

RELIABLE COIL PERFORMANCE—Proven Westinghouse-Sturtevant *plate fin* water or dehumidifying coils meet catalog ratings.

AMPLE SPRAY CAPACITY—Especially designed spray nozzles effectively wet and cleanse the entire surface of the coils.

EASY ACCESS—Coil connections accessible by removal of the cover plate on the coil connection box *without disturbing* piping and insulation.

RUGGED CONSTRUCTION—Airtight and watertight; casings are #16 gauge galvanized steel, reinforced with steel angles; tanks 3/16" thick steel asphalt coated.

ONE WARRANTY—Westinghouse makes all major components including coils. You get unit engineering and single equipment responsibility.

A new catalog, Number 1660, gives you complete data on how to select these surface dehumidifiers. Includes full psychrometric and coil performance data bound into one volume. For your free copy, call your local Westinghouse-Sturtevant office, or write: Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S

Westinghouse

J-80283

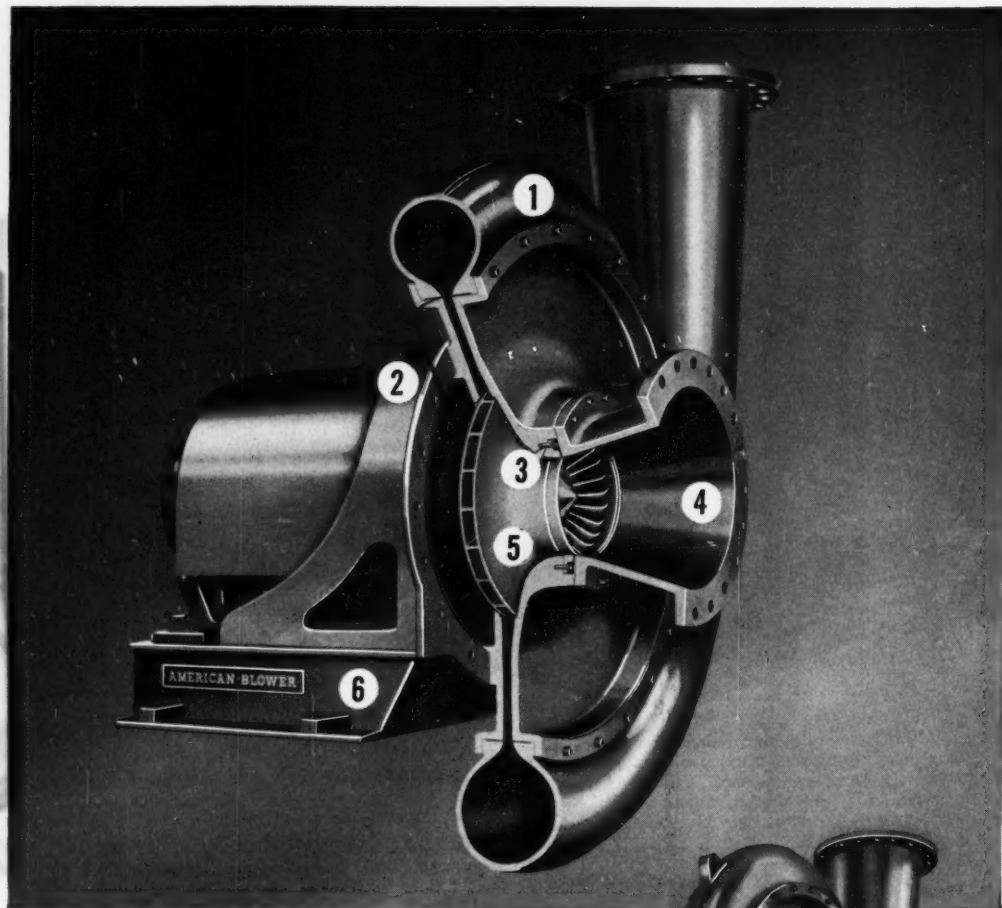
TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of political campaign over CBS television and radio.

CHEMICAL ENGINEERING—October 1952



AIR HANDLING

American Blower...a great



In cutaway view above: (1) Improved scroll-shaped casing design results in increased compressor efficiency. (2) Unobstructed, long diffuser passage converts velocity energy into pressure; provides quiet operation. (3) Annulus packing minimizes recirculation of gas around impeller inlet. (4) Removable inlet nozzle assures accurate alignment of annulus packing when assembled with impeller. (5) Aero-dynamic design of impeller blades results in high efficiencies, long life. (6) Welded steel baseplate is "stress relieved" prior to machining—assuring maintained alignment.



name in air handling, offers you

An outstanding line of centrifugal compressors

Single stage design. Sizes from 30 to 600 HP.

Pressures from 1¼ to 3¾ lbs.

If your job calls for delivery of large volumes of air or gases, dependable American Blower Single Stage Centrifugal Compressors are just the ticket.

They're compact, require minimum foundations, are adaptable to all types of drives—electric motor, turbine or engine.

Except for the bearings, no other parts come in contact with each other—holding maintenance to an absolute minimum. Air or gases do

not become contaminated since no internal lubrication is required.

Prior to shipment, each American Blower compressor is thoroughly tested in accordance with the A.S.M.E. Power Test Code for Centrifugal Compressors and Exhausters.

If you'd like complete, concise technical data, consult the nearest American Blower Branch Office or write us for Bulletin 109.

AMERICAN



BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN

CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary corporation

Serving home and industry: AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWAUKEE BOILERS • ROSS HEATER • TONAWANDA IRON



RUBBER INSULATED EQUIPMENT FOR THE CHEMICAL INDUSTRY

Engineering...

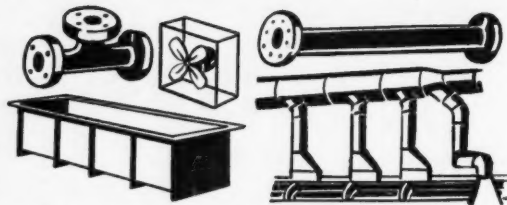
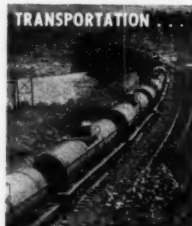
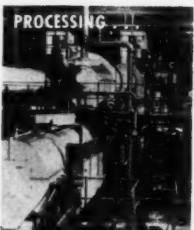
ARco specialized engineers and chemists co-operate to produce finished protective products to withstand contamination of acids, alkalis and other chemical solutions, liquids and gases . . . and to apply such protection in the most practical permanent manner.

Product Control...

ARco maintains modern laboratory facilities for research and control of its natural and synthetic rubber compounds which are then milled and calendared in our own plant for individual jobs.

Experience...

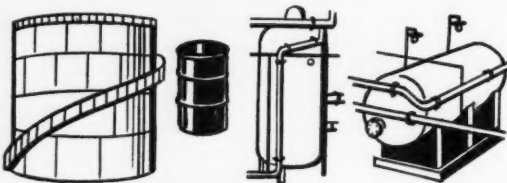
ARco craftsmen and their supervisors have many years experience in the protection of chemical equipment . . . the scaling off of chemical equipment against the properties found in chemical processing.



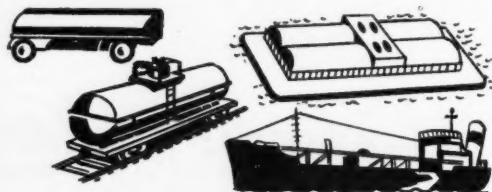
Tanks, pipe and fittings, duct work, fans, housings, exhaust and ventilation systems, conveyor flights, towers, etc.



Tanks, pipe and fittings, Agitators, filters, impellers, pumps, pressure vessels, industrial equipment, funnels, etc.



Open and Closed Tanks, Holders, Drums, Pipe and Fittings, etc.



Tank Cars, Truck Trailers, Barges and Shipwells, etc.

IN HOUSTON
ARCO RUBBER PROCESSORS
4833 Homestead Rd.
Houston, Texas

Anything can be Covered with Rubber

AUTOMOTIVE RUBBER COMPANY, INC.

Factory and Main Offices: 8601 Epworth Blvd., Detroit 4, Michigan

FACTORY- ASSEMBLED

OIL, GAS OR COMBINATION FIRED STEAM GENERATORS

**from 2490 lb.
steam per hour
up in a wide range of
operating pressures.**

2-drum water tube boiler-furnace heavily insulated and steel cased.

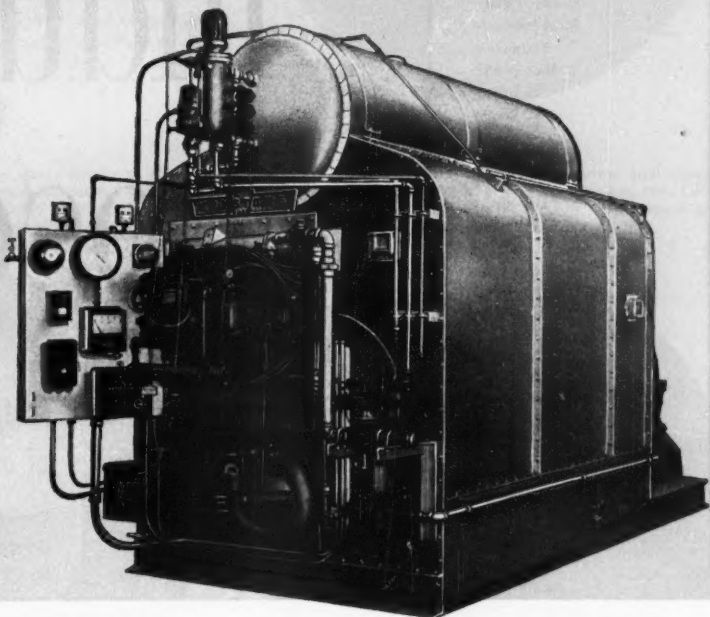
Completely assembled and wired at factory—needs only service connections.

Electronic controls with complete safety tie-ins.

Tested under full operation at factory.

Installed indoors or outdoors under supervision of factory engineer.

Eliminates need for costly excavation, field brickwork or stack.



Locate A KEYSTONE Where You Need Steam

Keystone is big water tube boiler performance in a compact unit—permits you to make high pressure steam at or near the point of use. Keystone's are automatic and require only part time supervision. Keystone's give you flexibility for quick steam application to meet emergencies. They are efficient,

dry steamers, complete with all necessary instruments and safety controls—even the panels are wired at the factory and you can be on the line within hours of the arrival of your Keystone. Investigate the installation and operational economies of the Erie City Keystone Steam Generator.



For complete data ask for Bulletin SB-38V
You can depend on Erie City for sound engineering
ERIE CITY IRON WORKS • Erie, Pa.
STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

**Industries served
by VU Boilers**

Aircraft
Asphalt
Automobile
Breweries
Building Materials
Carpet
Cellophane
Cement
Chemical
Coal Mining
Coke
Cold Storage
Dairy
Department Stores
Distilling
Explosives
Electrical Equipment
Electric Power
Food Products
Foundries
Gas Works
Gelatine
Glass
Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
Oil Refining
Paint
Paper
Public Utilities
Radio
Railways
Refrigeration
Rubber
Schools
Sewage Plants
Shipbuilding
Sugar
Textile
Tobacco
U. S. Government

Leaders in every Industry choose VU

**Typical Leaders in the Textile Field that have purchased
C-E Vertical-Unit Boilers for one or more mills**

American Thread Company
American Viscose Company
American Woolen Company, Inc.
Bancroft & Sons Company
Bigelow-Sanford Carpet Company
Burlington Mills Corp.
Cannon Mills Company
Celanese Corporation of America

Cone Mill Corp.
Congoleum-Nairn, Inc.
Dan River Mills
Goodall-Sanford, Inc.
Mohawk Carpet Mills, Inc.
Standard-Coosa-Thatcher Company
Textron, Inc.
West Point Manufacturing Company

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS, ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

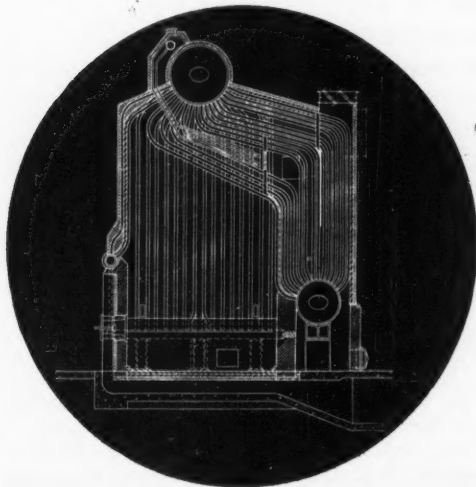
More and more . . . in industry after industry . . . you will find C-E Vertical-Unit Boilers (Type VU) establishing the standards for efficient steam production.

In **Textile Mills**, for example . . . where steam must be reliably available for process work . . . many of the industry's leaders, as evidenced by the representative list opposite, are users of Type VU Boilers.

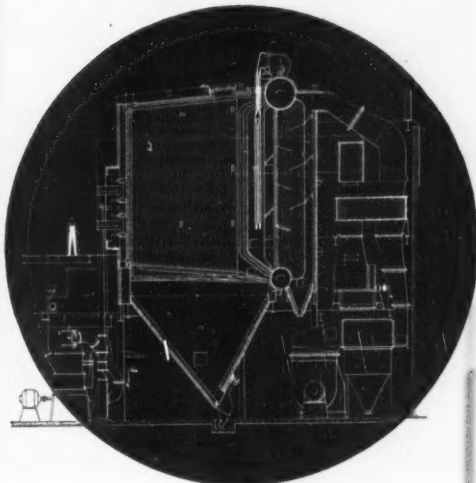
Why list only large companies when VU Boilers are also used by many smaller textile mills? Because such names form a significant guide for a prospective boiler buyer, in the same sense that the buying decisions made by operators of large truck fleets can be a reliable guide for the man who wants to buy a single truck. Moreover big companies buy boilers frequently . . . therefore their experience is always up to date. And they buy them for plants in many locations, using many different fuels. Thus they have the breadth of experience that is required for making the soundest equipment selections.

So if you need steam — from 10,000 to 300,000 pounds per hour — remember that leading companies in every industry are profiting from the advanced design . . . sound construction . . . reliability . . . of C-E Vertical-Unit Boilers.

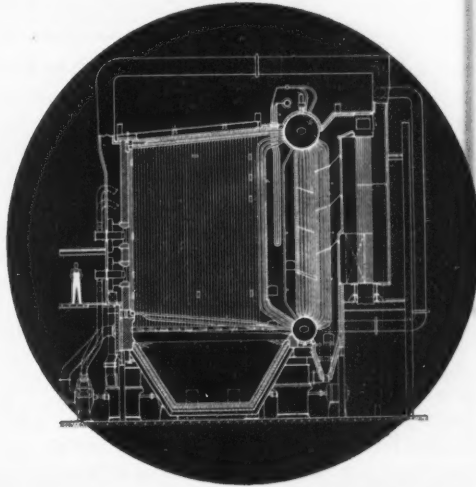
VU-10 Boiler fired with oil or gas. Capacity of this unit is 40,000 lb of steam per hr at 420 psi and 600 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, under-feed or traveling grate stokers.



VU-50 Boiler fired with pulverized coal supplied by C-E Raymond Bowl Mills. Capacity—150,000 lb of steam per hr; steam pressure, 600 psi—temperature, 700 F.



VU-50 Boiler fired either with pulverized coal using C-E Raymond Bowl Mills, or oil as an alternate fuel. Capacity is 100,000 lb of steam per hr. Steam pressure is 200 psi; steam temperature is 500 F.



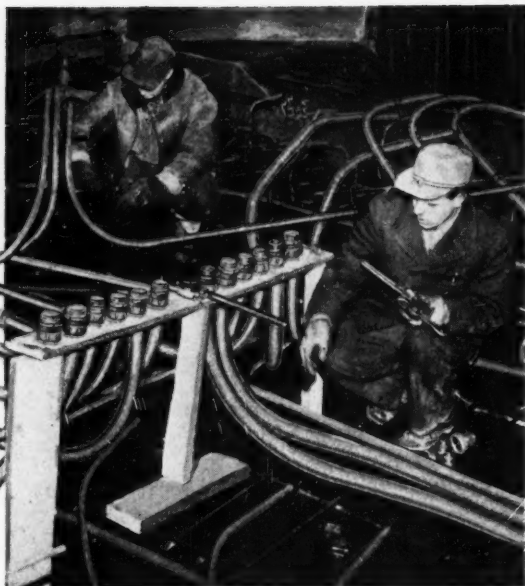
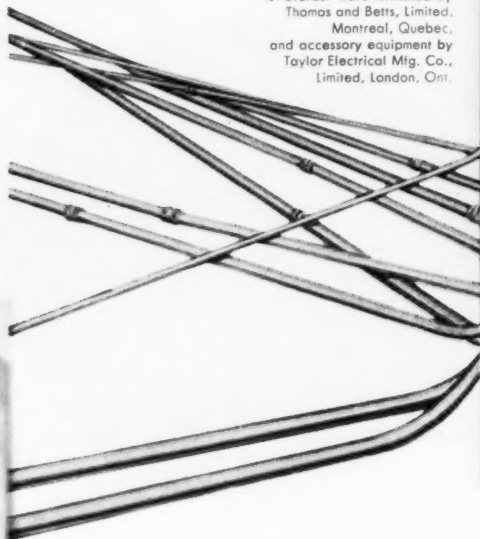
— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.



B-572

Workmen on the Toronto Subway are shown running Everdur EMT Conduit. EMT saves labor compared with threaded rigid conduit. Fittings of Everdur were furnished by Thomas and Betts, Limited, Montreal, Quebec, and accessory equipment by Taylor Electrical Mfg. Co., Limited, London, Ont.



EVERDUR for Canada's first subway

Toronto Transportation Commission uses 158,750 feet of rustproof Everdur EMT Electrical Conduit (½" to 2") for all circuits except train power lines.

When you design a structure for a service life of from 50 to 100 years, you specify material carefully. Cost is always a factor — but cost considered in terms of long-range maintenance.

Toronto's rapid transit builders knew some of the troubles that developed in existing systems. They knew rusting could be troublesome . . . especially with electrical conduit. They considered many types . . . balanced price with durability. Their final decision was gratifying to us—Everdur* EMT for all buried conduit! Watertightness was not required. Inside the tubes, condensation would occur, whether from leakage or not. The entire system is self-draining at various outlet boxes.

Not only is all conduit Everdur-1015, but all compression fittings are made of Everdur-1000 ingot. All junctions, panels and boxes are Everdur-1010 sheet.

Corrosion resistance is, of course, Everdur's strong point. But it is also nonmagnetic. And its smooth bore means easy and rapid wire pulling.

We know Toronto will never regret its choice. Since its first use twenty years ago, Everdur has consistently outlasted ordinary conduit. It is available in two wall thicknesses: rigid conduit (RC) in nominal sizes from ¼" to 4" inclusive; and the thinner-walled electrical metallic tubing (EMT) used in the Toronto Subway, in nominal sizes from ¾" to 2".

For detailed information, uses, and specifications why not add to your reference shelf now by writing for Anaconda Publication E-12 on Everdur Conduit? The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

62154

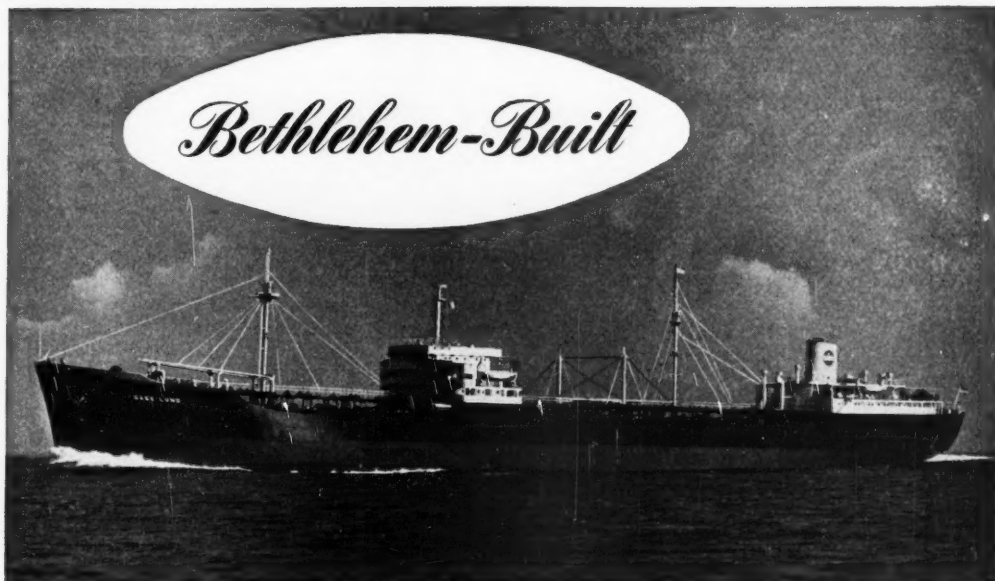
EVERDUR — ANACONDA

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STRONG • WELDABLE • WORKABLE • CORROSION-RESISTANT

Bethlehem-Built



A 28,000-ton Bethlehem-Built tanker on delivery trials.

1,746,100 DWT of Tanker Capacity

Since the beginning of 1948, Bethlehem's shipyards have delivered or booked orders from private interests for the construction of 68 tankers in eight different sizes. Ranging from 12,800 to 45,000 tons in capacity, these tankers aggregate 1,746,100 deadweight tons.

This is one of the largest and most diversified tanker building programs ever undertaken by a single company.

A building program of this magnitude does not just happen. Nor does it reflect "stray orders" or "emergency tonnage."

What it does reflect is the considered placement of business by shipowners who know that Bethlehem can be counted upon to produce ships that meet the

specific requirements of the individual operator and provide many years of high-standard, low-cost service.

It does reflect repeat orders from operators who placed into service the 34 Bethlehem-Built tankers completed under this program to April 30, 1952. These men know from their own performance records that Bethlehem-Built tankers are dependable and efficient.

And it does reflect the fact that experienced marine personnel know that these tankers will have that important *something extra*—the inherent characteristics which for almost half a century have distinguished every ship bearing the title, "Bethlehem-Built."



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Boston Harbor	New York Harbor
Baltimore Harbor	Beaumont, Texas
Los Angeles Harbor	San Francisco Harbor

SHIPBUILDING YARDS

Quincy, Mass.	Staten Island, N. Y.
Sparrows Point, Md.	Beaumont, Texas
Terminal Island, Calif.	San Francisco, Calif.

SHIPBUILDERS

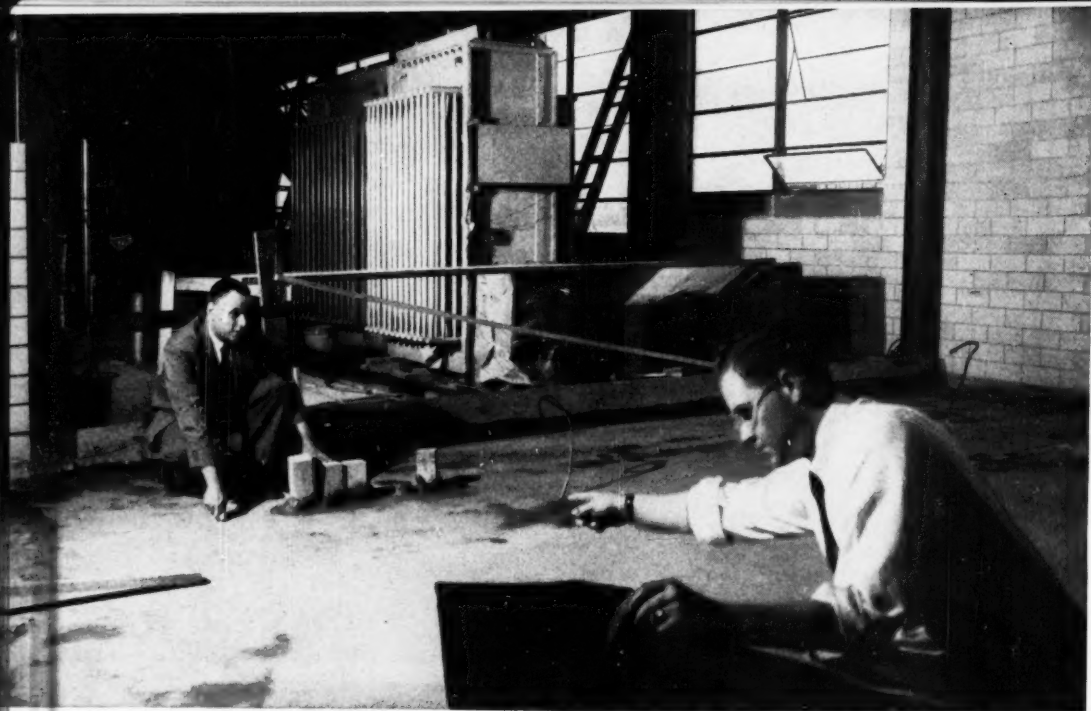
SHIP REPAIRERS

BETHLEHEM STEEL COMPANY

Shipbuilding Division

General Offices: 25 Broadway, New York 4, N. Y.

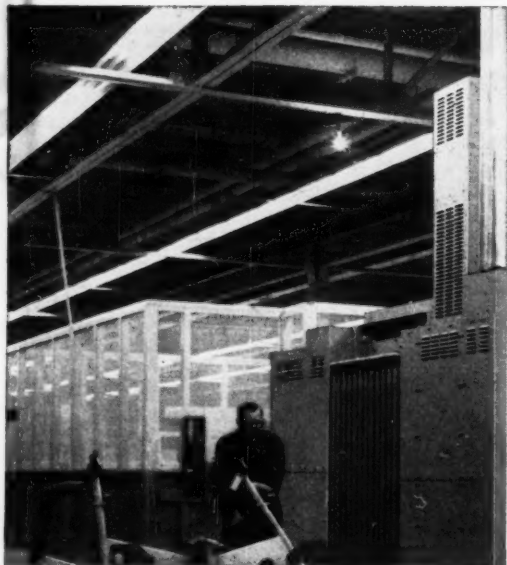
On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation



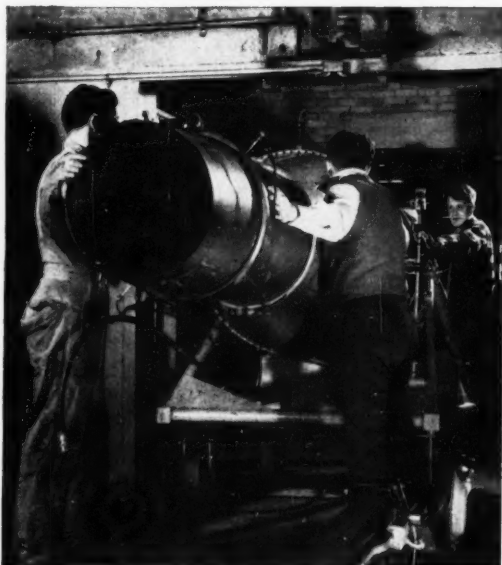
TRANSFORMERS FOR POWER TO MANUFACTURE JETS. While power house is built, locations are marked for the two 750-kva transformers shown in background. The double-ended load center,

ready for installation here, will serve auxiliary loads for Packard's new jet engine plant in Utica, Mich. Plant also contains six G-E load-center unit substations installed in three groups.

Load-center units speed building



G-E HIGH-VOLTAGE LIGHTING gives Packard adequate lighting with maximum flexibility and savings in copper and equipment costs



READY FOR JETS. When completed, Packard test cell will look like this—test J-47 jet engines built for U.S. Air Force.



LAYOUT FOR SECONDARY SELECTIVE SYSTEM. A 1500-kva double-ended load center, being installed, is typical arrangement for secondary selective distribution at Packard. Each transformer is

750 kva. High voltage is 4800 volts. Load center functions like two substations built into one, with tie circuit breaker between the two buses. Low voltage is 480Y neutral grounded.

of Packard's new jet engine plant

Secondary selective system with 480Y-v grounded neutral assures low-cost power continuity

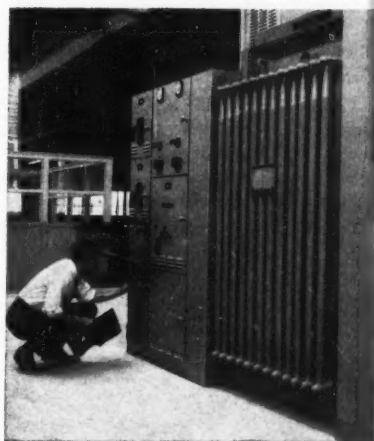
By using pre-assembled G-E load-center unit substations, Packard Motor Company was able to get a fast, inexpensive installation job on the power distribution system at its new jet engine plant in Utica, Mich.

Location of six load-center substations, arranged in pairs of three 1500-kva double-ended load centers, kept pace with construction of the plant bays themselves. A double-ended load center for auxiliary loads went into the power house even before it was completed.

The secondary selective distribution system chosen by Packard assures extreme reliability through its low-cost emergency tie, providing an alternate power source for the load area should either transformer go out. This system also saves cable, reduces operating hazards through low-voltage transfer switching, and permits removal of feeder, transformer, or main secondary breaker for maintenance without dropping service on either low-voltage bus.

For further information on G-E engineered load-center unit substations, call your local General Electric sales representative, or write for GEA-3592, General Electric Company, Schenectady 5, New York.

121-08



SIMPLE INSPECTION. G-E Type AK-1 breaker for low-voltage side pulls out easily for inspection. Big AL-2 breaker is to right center of others.

GENERAL  **ELECTRIC**



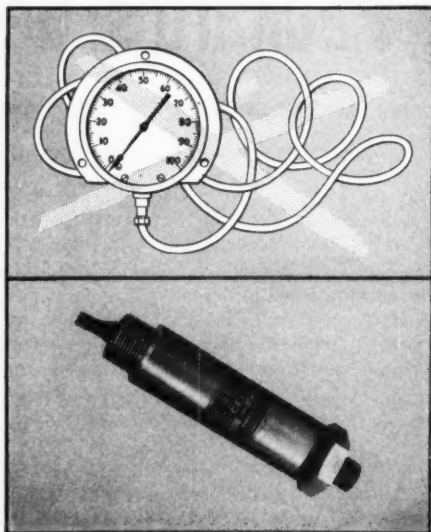
With versatile Baldwin Pressure Cells measurement of fluids and gases can *now* be made with far greater safety, accuracy and speed than with conventional methods. No longer is it necessary to contend with the inaccuracies and hazards of fluid measuring systems . . . to lose valuable time in obtaining readings from widely scattered monitoring stations.

Baldwin Pressure Cells can be installed at any desired location throughout your plant. Through electrical connections, reports from remote stations can be picked up at *one* central control point.

Use Baldwin Pressure Cells—for pressure measurement on pipe lines—for depth gaging storage tanks . . . to provide a record of levels on indicating, recording or alarm instruments—in research operations . . . to measure ultra-high pressures, surges and explosion waves.

Freedom from moving parts insures the longest possible life and virtually abolishes all hysteresis and inertia effects.

It will pay you to check any of your pressure measurement problems with your nearest Baldwin representative. Write for information . . . *today!*



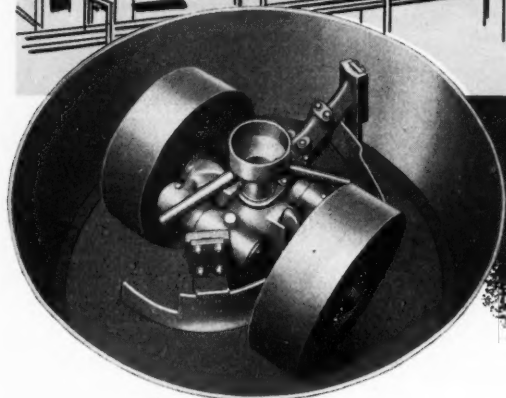
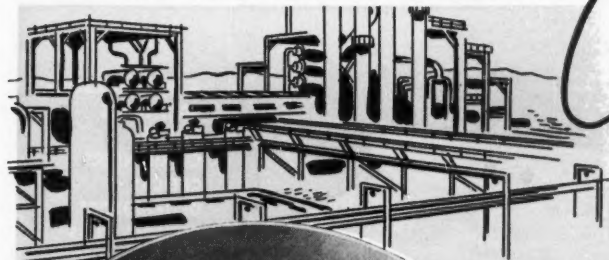
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**DO YOU REALLY KNOW
 WHAT MULLING IS...?**

Watch the practiced technique of a chemist's mortar and pestle—the intensive smearing and rubbing action—and basically, *THAT'S MULLING!*

Mulling with a Simpson Mix-Muller utilizes a special pair of revolving mullers and plows mounted on a stationary pan. The mullers are adjustable and are supported by rocker arms so that they can be free to ride on the material—creating a true mulling action as they revolve... eliminating balling and quickly developing maximum blending of the mix.

Simpson Mix-Mullers may be specially equipped for heating and cooling while mixing—for mulling under vacuum or pressure—for corrosive materials—or to function as a reaction vessel.

It takes today's modern technology to profitably produce catalysts that are of uniform quality—that have excellent heat, steam and chemical stability. Speed and accuracy must be combined to assure a better end product at lower cost.

Increasing numbers of catalyst producers are finding that Simpson Mix-Mullers prepare their product much faster and more accurately than with any other method. There is no balling of materials. Blending is completely uniform. The mixing cycle is shorter for comparable results. That's because Simpson Mix-Mullers incorporate the true mulling principle of controlled mixing.

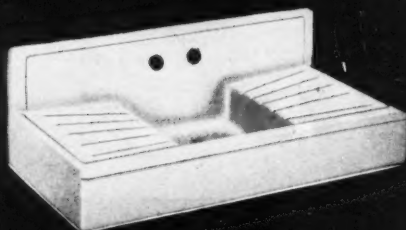
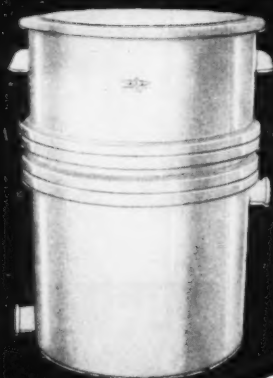
It's true with the production of catalysts... and it's true throughout the chemical process industries... today more Simpson Mix-Mullers are in use than ever before. If you prepare dry—semi-dry—or pasty materials—then consult a National Engineer or send for our latest catalog.



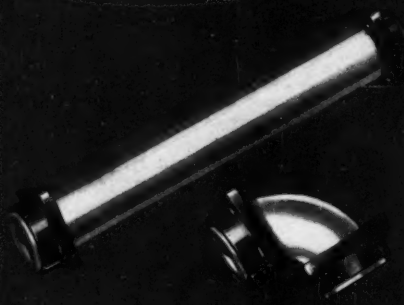
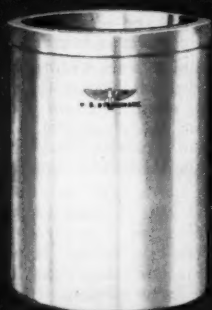
SIMPSON Mix-Muller Division

NATIONAL ENGINEERING CO. 1000 W. 10TH AVE. CHICAGO 5, ILL.





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THE *Chemmentator*

Reg. U. S. Pat. Off.

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

Novel process yields magnesium oxides

At its Carlsbad, N. M., refinery, International Minerals & Chemical has under construction a chemical plant for the production of hydrochloric acid and various types of high-grade magnesium oxides.

The process involves the utilization of byproduct liquors now wasted from the potassium sulphate plant. It was developed by International's researchers.

The new chemical plant will be integrated with the Carlsbad refinery. It should be operating by July 1953.

Hassle over taxation of research

The nation's commercial research and testing laboratories and their rivals, the non-profit research institutes, are girding for a showdown on a new regulation by the Bureau of Internal Revenue. The new regulation pinpoints for the first time "research" and "fundamental research" as they apply to "unrelated income" from research contracts.

The new interpretation will result in tax liabilities for non-profit research institutes that show a profit on their commercial testing work. It's effective on 1951 income.

Commercial testing laboratories complain that it's unfair to exempt non-profit research centers doing commercial work from paying taxes. The testing laboratories charge that the non-profit institutes plow back their earnings into more and better equipment, while the commercial organizations have much of their profits taken away as taxes.

The Bureau of Internal Revenue has long sought an equitable way to prevent institutions from dodging taxes under the guise of research.

Now the Bureau has issued its new regulation. "Research," according to this interpretation, does not include activities incidental to commercial or industrial operations, for example, routine testing of materials or equipment. "Fundamental research" does not include research for the primary purpose of commercial or industrial application.

Thus non-profit research institutes won't be able to call commercial testing or applied research "fundamental" and claim tax exemption.

The American Council of Commercial Laboratories insists that "research findings of tax-free institutions, no matter how financed, are in the public domain and should not be handed over privately to an individual

firm or organization." The Council's reasoning: the public pays part of the cost of this research through tax exemption and therefore it ought to get the benefit.

ACCL spokesmen such as the executive secretary, Dr. Harold M. Dudley, don't oppose non-profit institutions in fundamental research. In fact, they heartily agree with BIR's restatement of the regulations that continues tax exemptions for non-profit institutions on income from research for federal or state government units.

The Bureau's new regulation signals an upcoming fight between lawyers for the non-profit institutes on one side, and the commercial laboratories and the BIR on the other. Universities, for example, argue that they should have some benefits such as being able to operate commercial enterprises to raise money to replenish their coffers. But the commercial laboratories insist that no one should get special treatment in tax matters, especially at the expense of private enterprise.

What is a professional engineer?

Professional engineers whom Congress exempted from wage controls have now been defined by the Wage Stabilization Board.

The definition is identical with that issued in July by the Salary Stabilization Board. This covers salaried engineers under SSB's jurisdiction.

The interpretation stresses that an engineer must be employed in his professional capacity. The exemption from wage controls does not apply to engineering assistants, nor to physicists, mathematicians, chemists and other scientists.

Japanese pulp makers covet Alaskan timber

Ever since Japan's wartime loss of Sakhalin Island and the maritime provinces of Manchuria, the Japanese pulp industry has been eyeing Alaska as a possible new timber source.

The Japanese government reportedly is negotiating with the U.S. State Department for the organization of a \$20 million Japanese-United States corporation to exploit resources of the Tongass Forest in southeastern Alaska. The Japanese would like to use their own labor to cut down trees and raft the logs to Japan.

A delegation of about 15 Japanese plans to visit the U. S. to discuss the organization of a \$20 million company and a \$10 million loan, according to Philip

(Continued on page 106)

THE CHEMENTATOR, continued

M. Crawford, regional director at Seattle for the Commerce Department. Crawford denies unofficial reports that the Japanese proposal amounts to a virtual ultimatum: "Either give us the Tongass timber or we'll turn to Russia."

The Commerce Department has been getting protests from business groups that believe the United States should be the sole developer of Alaska's timber resources. Among objectors are Puget Sound Pulp & Timber Co., undertaking a \$40 million pulp development near Ketchikan, Alaska, to use Tongass National Forest timber, and Rayonier, Inc., which has applied for Tongass Forest timber to use in its plants in the United States.

Streamlining the Patent Office

Despite a cutback in funds, the U. S. Patent Office is eating into the backlog of patent applications accumulated since World War II.

There were but 97,000 actions pending on examiners' desks as of September 20. This compares with a backlog of more than 200,000 three years ago.

Commissioner of Patents John A. Marzall attributes the improved position to increased efficiency of operation. During fiscal 1952 the Patent Office granted 46,531 patents.

The Patent Office is now proposing changes in the rules of practice as a result of a new law that codified all substantive law on patents. The rules are to be modified to conform to the law. Patent attorneys are being called in to advise and comment.

Among changes proposed is a general revision of many of the charges made by the Patent Office. Even now the Patent Office is largely self-sustaining. It received \$4,377,000 in fees during fiscal 1952. Part of this income derived from the sale of more than 44 million printed copies of patents and trade marks.

For chemicals, a brave new world

CHEMICAL REVOLUTION—The vast and briskly competitive chemical expansion now in progress throughout the world may foreshadow a revolution more sweeping than the Industrial Revolution of the 19th century. So predicts Maurice F. Crass, Jr., secretary of the Manufacturing Chemists' Association.

GROWTH IN U. S.—In the United States, chemical production since 1939 has grown at a rate more than 2½ times faster than that of all other production. In a decade, sales of chemical and allied products have mushroomed from a total of \$4.86 billion in 1940 to \$18.5 billion in 1951, an increase of 280 percent.

EUROPE'S ROLE—Meantime, foreign nations have not been idle. "In the United Kingdom," Crass says, "chemical exports exceeded all other categories of goods during 1951, totaling \$403,817,000. Germany has come back strongly into world markets, with 1951

exports of chemicals totaling \$302 million. With the industrial nations of the free world once again on a self-sustaining basis," declares Crass, "we can look forward to keen competition in our chemical trade."

EUROPE VS. U. S.—Wage rates in Europe's chemical industry run from one-fifth to one-third those of the United States. Hence the U. S. is at a serious competitive disadvantage, Crass points out, when it comes to costs. Further, high concentration of the industry in Europe facilitates formation and operation of cartels to protect against foreign imports, even while U. S. tariffs have been reduced to the legal minimum. Two companies control 85 percent of production in the United Kingdom; in France, two companies control 95 percent; in Italy, two companies control 80 percent; and in Switzerland, three firms control 95 percent.

The U. S. chemical industry, on the other hand, faces none of the long-term raw material problems that confront other industrially developed nations of the free world, according to Crass. This is extremely important to national security "since no nation, however strong in other respects, can successfully wage an offensive or defensive war unless it has an integrated chemical industry. Almost all the 7,000 chemicals in regular production in the U. S. funnel into the defense effort."

RESEARCH THE KEY—Crass attributes the tremendous growth of the U. S. chemical industry to large expenditures for research. "In number of scientists and engineers employed in research," he says, "the industry leads all others. Research expenditures total roughly 20 percent of the \$1.1 billion spent by all U. S. industry for this purpose. Moreover, the investment in plant per production employee is high, being in the neighborhood of \$30,000."

Vast outlay for petroleum research

Petroleum industry will spend \$130 million on research alone in 1952, according to Dr. Gustav Egloff, research director of Universal Oil Products.

Not only are the industry's 17,000 scientists constantly seeking better fuels and lubricants, but they are hard at work producing new chemicals from petroleum and natural gas. This multiplies the need for trained men.

Petrochemical investment, Egloff says, has jumped from \$350 million in 1940 to more than \$2 billion today. And more is being planned.

Trend to nitric acidulation

Producers of phosphate fertilizers are turning increasingly to nitric acid for the acidulation of phosphate rock.

Allied Chemical & Dye Corp. will use such a process at its new \$6 million fertilizer plant at South Point, Ohio.

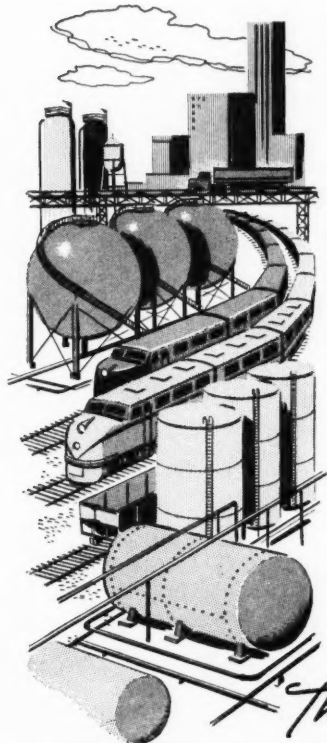
Associated Cooperatives, Inc., which expects to be
(Continued on page 110)

INSUL-MASTIC SUPERIOR *Coatings*

When you want to prevent corrosion under difficult conditions . . . to keep moisture vapor out of insulation . . . to control heat loss and rust with the same coating . . . to resurface leaking walls . . . you want a coating the durability of which has been unquestionably proven by industry. Here are five reasons

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Insul-Mastic *superior* coatings provide extra long term protection. This is due to the superior ingredients from which they are manufactured and is attested to by Weather-O-Meter tests and actual field applications of many years duration.

2

Insul-Mastic *superior* coatings with their Gilsonite base are practically inert. Therefore, they are resistant to almost all acids and alkalis.

3

Insul-Mastic *superior* coatings keep surfaces dry. The moisture vapor transmission rate is only .01. This makes them ideal for vapor-sealing thermal insulation.

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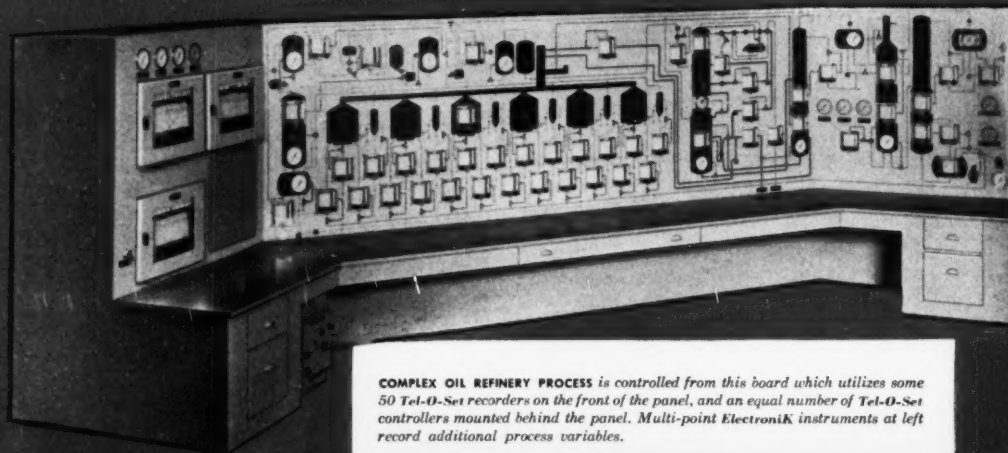
Insul-Mastic *superior* coatings contain an extremely high percentage of solids and thus, can generally be built up to their specified thickness in a single application . . . and, their shrinkage on drying is greatly minimized.

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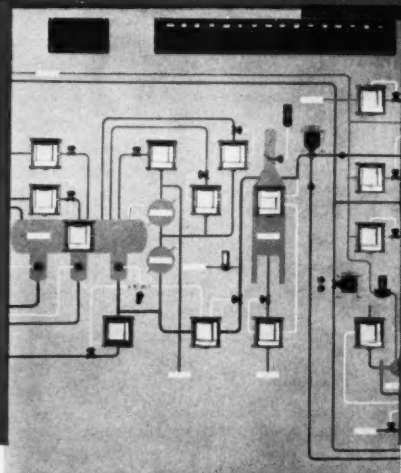


Graphic Panels for Centralized Instrumentation...

These well-known companies are taking advantage of Honeywell's specialized knowledge in the design, construction and operation of graphic panels:

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The Fluor
Corporation Ltd.
Foster-Wheeler Corp.
Great Lakes Refinery
Imperial Oil of Canada
Inter-Mountain Chemical
International Refineries, Inc.
Kantotex Refining Co.
The Lummus Company
Northwestern Refinery

Pan-Am Southern
Phillips Petroleum Co.
The Refinery
Engineering Co.
Rohm and Haas Co.
Shell Oil Co.
Sinclair Refining Co.
Socony-Vacuum Oil Co.
Southwestern
Engineering Co.
Standard Oil Co.
of California
Standard Oil Co.
of Indiana
Standard Oil Co.
of New Jersey
Sunray Oil Corp.
Sutherland Refiner Corp.
Union Oil Co.
of California
Vickers Petroleum



FUNCTION-DESIGNED CONTROL for a large refinery includes this section in a large graphic panel by Honeywell—using front-of-panel Liquid Level Indicators and Tel-O-Set recorders, plus Tel-O-Set controllers behind the panel.

PANEL PRODUCTION

in Honeywell's extensive shop, devoted exclusively to panel work—utilizes the skills of highly trained specialists. All instruments, controllers, accessories, and back of panel wiring and piping are carefully assembled—then subjected to rigorous tests to assure trouble-free installation and start-up when the panel reaches your plant.



... a progress report from Honeywell

SHOWN at the left are just two of the many graphic instrument panels which Honeywell has supplied for centralized control of a wide variety of industrial processes. Each one is the result of well-seasoned engineering know-how... based on extensive Honeywell experience... which combines all instruments and accessories into a closely integrated, efficient design.

Whether your process calls for a full graphic or semi-graphic panel... a conventional board... or a control cubicle... you can be sure of obtaining every feature of quality and performance that you need in a Honeywell panel.

In Honeywell's Panel Division, meticulous attention to engineering detail and highly developed

construction techniques watch over every step—from blueprint to assembly to final test. Add to this engineering and manufacturing skill the availability of a complete line of conventional and miniature instruments, and the result is a control board... custom-fitted to your needs... that makes *Panels by Honeywell* synonymous with the best in centralized control.

Our local engineering representative will be glad to discuss how graphic panels by Honeywell can bring new efficiency to your processes. Call him today... he is as near as your phone.

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THE CHEMENTATOR, continued

turning out 60,000 tons a year of mixed fertilizer when its Sheffield, Ala., plant gets going next year, will also acidulate with nitric. Eventually, Associated plans to build its own acid plant to produce 60 tons of nitric per day.

At Sandy Point, Me., Northern Chemical Industries will build a \$1.5 million nitric acid plant as part of a \$2.1 million construction program, which will include a unit for acidulating phosphate rock and a \$600,000 mixing plant. Present superphosphate manufacturing facilities will be adapted to the nitric acidulation method. Northern will use nitric acid in the manufacture of ammoniated superphosphates, which will be mixed with muriate of potash and sold as a complete fertilizer. The company expects to produce about 16,000 tons a year of nitric acid from ammonia.

Mathieson Chemical, like Allied a big sulphuric producer, is likewise eyeing the process. Chemical Construction Corp. has a pilot plant, and so does Imperial Chemical Industries. Many of Europe's fertilizer plants use nitric acidulation commercially.

Principal reasons for the switch to nitric: (1) it conserves sulphuric acid, which is either partially or wholly replaced; and (2) it's inherently more economical. TVA, which developed the method, says a producer with captive ammonia or nitric acid facilities can produce the cheapest phosphate fertilizers in the world.

Another triple superphosphate producer

Recently formed Crescent Chemical Co. will build a triple superphosphate plant at La Porte, Tex., 25 mi. south of Houston. It will add 825 tons per day to the nation's current output.

Getting the sulphuric to keep this new plant going won't be easy. Crescent might even have to build its own acid plant.

Gaseous diffusion: Goodyear gets the nod

The Atomic Energy Commission has picked Goodyear Tire & Rubber Co. to operate the giant \$1.2 million gaseous diffusion plant to be built near Portsmouth, Ohio. The plant will produce uranium 235.

When the plant is completed four years from now, Goodyear will be the principal employer there, with a force of about 4,000 workers.

Goodyear will work closely with Union Carbide & Carbon Corp. Carbide operates the gaseous diffusion plants at Oak Ridge, Tenn., and Paducah, Ky., and has done the process development and engineering design for each of the diffusion plant additions built since 1946. Carbide will help to train key Goodyear personnel.

AEC decided that Union Carbide would not operate the new Portsmouth plant because the government wants other industrial companies to participate. Specifically, the AEC feels and Carbide agrees that it would be unsafe for the nation to have only one company with

experience in operating plants using the gaseous diffusion process. Carbide has operated all gaseous diffusion units at Oak Ridge and Paducah since the start of the atomic energy program.

Uranium now comes from phosphate rock

Four chemical companies will extract uranium from phosphate rock for the Atomic Energy Commission.

First to get into commercial production is Blockson Chemical Co., now recovering uranium at its phosphate chemicals plant near Joliet, Ill.

The other three, International Minerals & Chemical, Virginia-Carolina Chemical and Texas City Chemicals, are now building full-scale recovery units. International and Virginia-Carolina have plants under construction near Mulberry, Fla., and Texas City Chemicals is building a recovery unit at Texas City, Tex.

All four plants will use Florida phosphate rock. Uranium occurs in the phosphate deposits of Florida and several western states. The uranium can be recovered when phosphate rock is processed during the manufacture of sodium phosphate chemicals and commercial fertilizers.

Blockson designed and built its own recovery unit. AEC has contracted to take the uranium.

Box score on chemical expansion

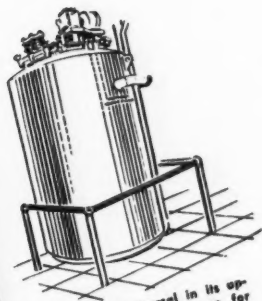
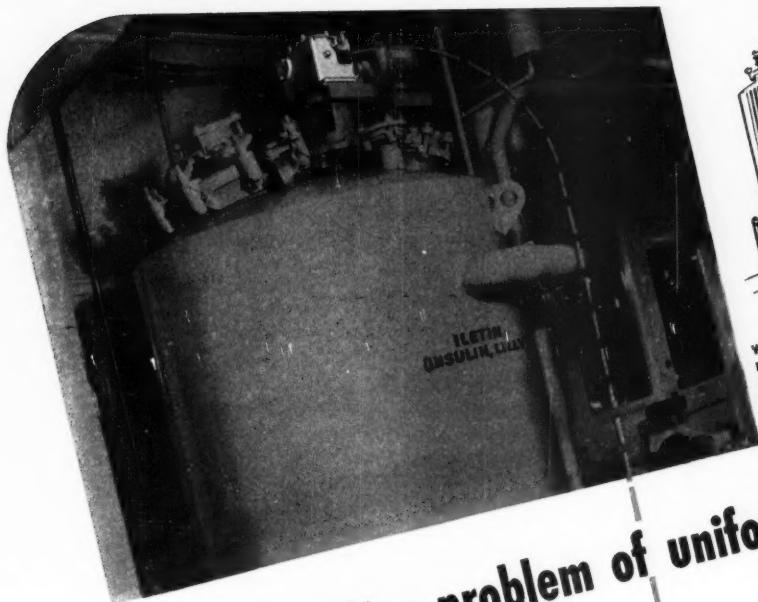
The U. S. chemical industry's defense expansion, exceeded only by that of the steel industry, is nearing its goal. Since Korea, when the expansion began, capacity has been added to meet soaring demand for such basic chemicals as ammonia, sulphur, chlorine, and benzene from petroleum.

Goals set for production of these chemicals, compared with pre-Korea, represent such increases as 50 percent for chlorine and caustic, 25 percent in nitrogen-producing facilities and 80 percent in benzene capacity.

Increased production of the more important chemicals for defense is called for in 43 expansion goals. These include: eight coal chemicals, nine other organics, five solvents, 11 inorganic chemicals, four agricultural chemicals, and oxygen, vulcanized fiber, carbon black, activated carbon, plastic materials and penicillin.

Of the 43 important chemical expansion goals set, 29 have now been reached. In coal chemicals, these are aniline, anthraquinone vat dyes, phenol and phthalic anhydride. Other organic chemicals include butadiene, ethylene glycol, ethylene oxide, methanol, ethyl alcohol and sebacic acid. Goals have likewise been reached for such solvents as carbon tetrachloride and methyl chloride. Inorganics include calcium carbide, chlorine, hydrofluoric acid, hydrogen peroxide, synthetic yellow iron oxide, phosphorus, sodium cyanide and soda ash. Agricultural chemicals comprise primarily benzene hexachloride, DDT, lindane and nitrogen. Other

(Continued on page 112)



Worm gearing—universal in its application—affords advantages for almost every power transmission job.

The Cleveland VD unit atop this 275 gallon tank drives a stainless steel agitator which mixes Insulin (Insulin-Lilly) for Eli Lilly and Company, Indianapolis, Indiana.

CLEVELAND whips problem of uniform solutions

INSULIN solution to the tune of 275 gallons per batch is mixed in this jacketed stainless steel tank. The agitator is driven by a Cleveland Type VD speed reducer—a worm gear unit whose steady performance helps to insure uniformity in the dilutions processed.

For forty years, Clevelands have mixed in the best companies, in the chemical and allied industries. In fact, wherever the need for a dependable vertical or horizontal right-angle drive arises, there you'll likely find Clevelands at work, operating dryers and kilns, screw conveyors, bucket elevators, mixers and agitators, as well as other industrial equipment.

For full information to help solve your own power transmission problems, send now for new Catalog 400. The Cleveland Worm and Gear Company, 3273 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Ltd.

CLEVELAND
Worm Gear
Speed Reducers



THE CEMENTATOR, continued

chemicals for which goals have been met: chiefly styrene monomer and methyl styrene, and penicillin.

At present, production of 14 chemicals still falls short of demand, and more capacity must be added with or without the help of fast tax amortization. Expansion targets for coal-tar chemicals in this category are: naphthalene, 40 million pounds; quinoline, 3 million pounds; resorcinol, 2 million pounds.

Other organics for which added capacity is needed are: formaldehyde, 48 million pounds; synthetic glycerine, 23 million pounds. In solvents, a goal of 8 million pounds is sought for perchloroethylene, of 10 million pounds for trichloroethylene, and of 34 million pounds for methylene chloride.

Inorganic chemicals still shy and their expansion goals: titanium dioxide, 27 million pounds; sodium chlorate, 3 million pounds; lithium compounds, 640,000 pounds. Oxygen production is to be lifted to 2.25 million cubic feet; output of vulcanized fiber to 4 million pounds; and capacity for plastic materials to 993 million pounds.

Chemicals needed for polyamide fibers

DPA has called for expanded production of four organics used in making polyamide fibers, principally nylon, by the beginning of 1955. The four: adipic acid, adiponitrile, cyclohexane and hexamethylenediamine.

Capacity for production of adipic acid will be lifted to 265 million pounds, and for adiponitrile to 141 million pounds. Goal for cyclohexane capacity is 237 million pounds; hexamethylenediamine production will rise to 143 million pounds.

Still eligible for fast tax writeoffs are facilities to produce 27 million pounds of adipic acid and 47 million pounds of cyclohexane. Enough applications for quick amortization have already been received for the other two chemicals.

Du Pont holding company's stock sold

A syndicate of investment bankers has just sold to institutional investors a big \$17 million block of 3,000 common shares of the fabulous Christiana Securities Co., the Du Pont family's holding company. A secondary offering, this first large sale was effected by private placement at an undisclosed price. Bankers refused to comment on the transaction.

Stock of the huge trust, with total investments of \$1,133,339,000 at the end of last year, is quoted currently over the counter at \$5,875 bid and \$6,025 asked.

The stock is believed to have been the holding of the late Lamont Du Pont, who retired from the job of Du Pont board chairman in 1948. Once head of Christiana Securities also, he left at his death on July 24 this year an estate estimated at \$75,325,000 in personal property, plus \$325,000 in real estate.

It may be that the sale of the Christiana stock

was to raise, at least in part, the cash to pay the heavy federal and state taxes on the estate.

Christiana is capitalized at 150,000 shares of 7 percent cumulative preferred stock and 150,000 shares of \$100 par value common, authorized and all outstanding.

The big holding company's investments at the end of last year comprised 7,460 shares of the News-Journal Co., 7,210 shares of capital stock of the Wilmington Trust Co., 170,000 shares of General Motors common and 12,199,200 shares of Du Pont stock.

Boon to Canada's paint makers

First commercial production of pentaerythritol in Canada will begin next year when a new \$3 million plant of St. Maurice Chemicals Ltd. of Montreal starts producing at Varennes, Quebec.

St. Maurice Chemicals is a new company jointly formed by Shawinigan Chemicals, Ltd., and Heyden Chemical Corp. The plant at Varennes will produce 30 million pounds a year of formaldehyde and 3 million pounds of pentaerythritol. The solid alcohol will go to Canada's fast expanding paint, varnish, lacquer and resin industries.

Tire maker rolls ahead in chemicals

Keep an eye on General Tire's venture into chemicals. It's only two years since General Tire entered the chemical business, but already it has completed a \$1 million plant at Mogadore, Ohio, and is planning a \$6.2 million vinyl resin plant at Calvert City, Ky. And that's only the beginning.

The Mogadore plant has just turned out its first batch of polyester resins for use in binding glass fibers. Soon it will be producing high-styrene resins and other chemicals for the plastics and rubber industries.

Meantime, Robert Wittenberg, who heads General Tire's new chemical venture, frets impatiently while waiting to get started on a \$6.2 million vinyl resin plant. It's likely to be built at Calvert City, Ky., where the company has an option on 85 acres.

At Calvert City, General Tire could get raw materials via pipeline from neighboring plants. Pittsburgh Metallurgical, Pennsalt and National Carbide would all be nearby. Calvert City is fast becoming an important chemical center.

Currently, General Tire's chemical business is running at about \$3 million a year. The Mogadore plant will almost treble that. And General's Calvert City plant is slated each year to turn out vinyl chloride resins worth \$10 million. At least half the output will be grabbed by General Tire's other plants at a much lower cost to them.

All this won't satisfy Wittenberg, however. He's already at work on plans for a \$60 million plant expansion for production of petrochemicals and their derivatives. It's what General Tire would like to do in the next five or 10 years and would call for additional financing. —End

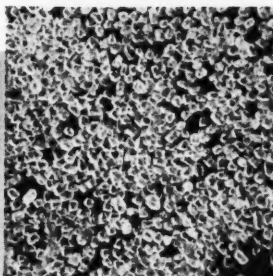


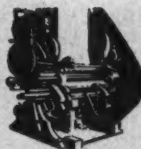
Photo of General Chemical's Superior New Large Crystal Oxalic Acid; Slightly Enlarged.



CLEANERS—For auto radiator cleaners. For cleaning rust from railroad cars and buses.



LEATHER & FURS—Vegetable tanning of sole and upper leathers; also bleaching of furs.



TEXTILES—For removing rust stains. In development of color when printing. For removing soil or smears after outline black printing.



DYES—In dye manufacture.



PENTAERYTHRITOL—In manufacture of pentaerythritol which is used in making surface coating resins and explosives.



CHEMICALS—For manufacturing oxalates and other chemicals.

If you need Large or Fine Crystal **OXALIC ACID**

For These or Other Uses

Call on General Chemical



LAUNDRIES—For laundry soaps and rust removers.



DRUGS—For manufacturing pharmaceuticals, antibiotics.



PLASTICS—As a polymerization catalyst or decoloring agent.

Whether you require Oxalic Acid in a large crystal form for manufacture of auto radiator cleaners . . . or a fine crystal material for exacting process uses . . . General Chemical can "fill the bill."

Long recognized for its consistently high purity, General's Oxalic Acid is a clear, colorless crystalline product which assays a minimum of 99.5% $C_2H_2O_4 \cdot 2H_2O$. It is now produced in large and fine crystal forms to meet every requirement.

If you use Oxalic Acid and have never tried General's product, do so now. Learn why so many users always specify "General Chemical" whenever they order. For samples and further information, call the nearest company office listed below.

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland • Denver • Detroit • Greenville (Miss.) • Houston • Jacksonville • Kalamazoo • Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh • Providence • St. Louis • San Francisco • Seattle • Yakima (Wash.)

In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.

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Available in convenient, easy-to-handle 100-lb. bags; also 400-lb. fibre drums.

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ALL-STEEL

DODGE-TIMKEN PILLOW BLOCKS

Rugged!

—FOR HEAVY DUTY
SERVICE!

Compact!

—LESS SPACE!
LESS WEIGHT!

HERE are the bearings for industry's toughest jobs—in the most compact and rugged "package."

High radial and thrust capacities. Stamina to take heavy shock loads. All-steel construction that packs this load-carrying capacity into less weight and less space than ever before.

This brilliant achievement has been accomplished through pooling the engineering resources and bearing-building experience of Dodge and Timken. This new line so completely fills a need that engineers are already specifying "Dodge-Timken All-Steel" for some of America's heaviest machinery and largest industrial projects.

Completely assembled, permanently adjusted, lubricated and sealed at the factory, these All-Steel pillow blocks are shipped ready to go to work—wherever in industry the going is tough!

For detailed information and delivery dates write to Dodge, or call your Dodge Distributor.

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of Mishawaka Ind.

CALL THE TRANSMISSIONER
your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone directory.





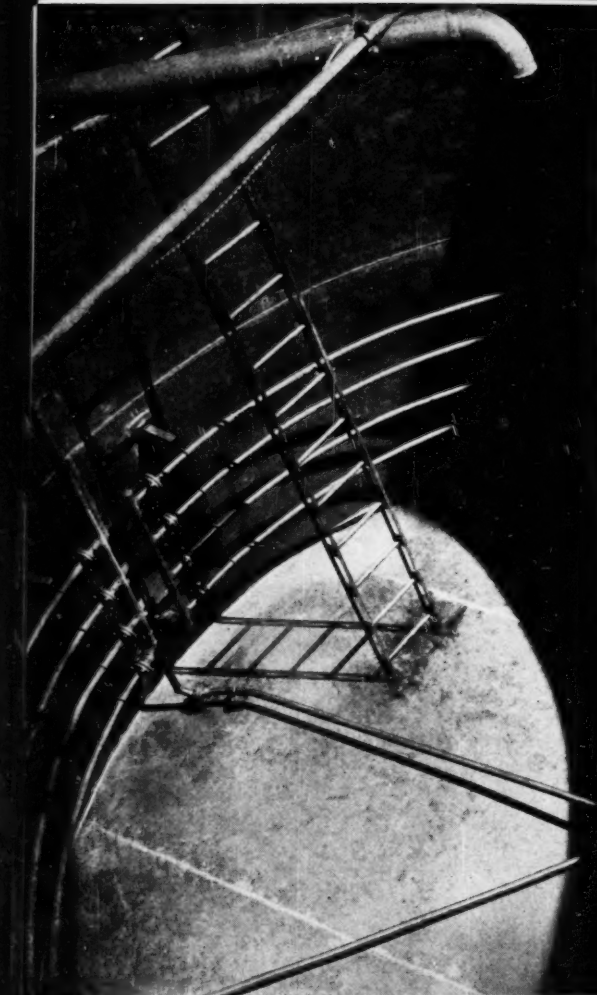
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ENGINEERING DEVELOPMENT
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COMPANY**




SHAFT SIZES: 2¹¹/₁₆ to 10 in.

- All-Steel construction
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- High radial and thrust capacities
- Compact—minimum dimensions
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DODGE MANUFACTURING CORPORATION, 200 Union St., Mishawaka, Indiana



Major Oil Refineries *use*



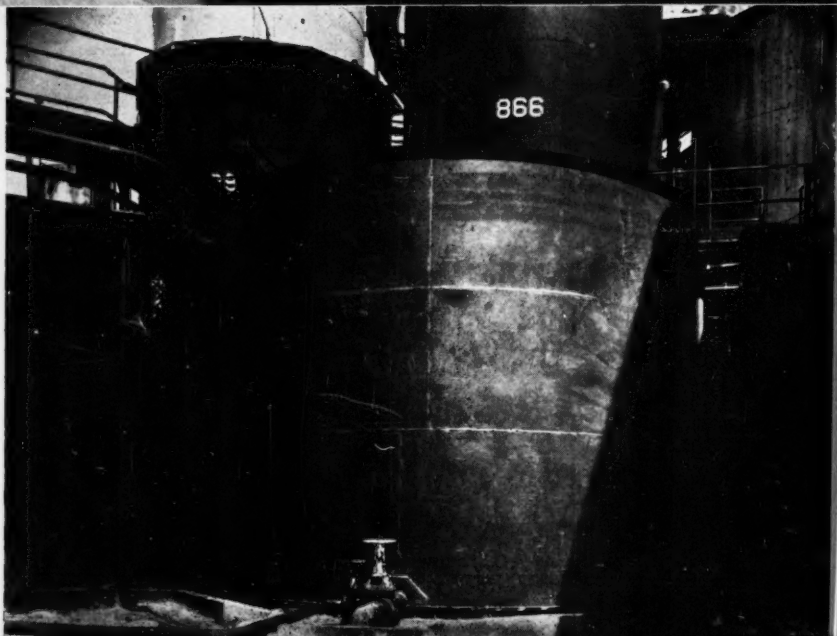

Inside view of tank showing construction. It was fabricated in three rings with Ampco-Trode electrodes. The top and middle rings are 3/16 inch Grade 8 Ampco Metal plate. The bottom ring is 1/4 inch Grade 8 Ampco Metal plate.

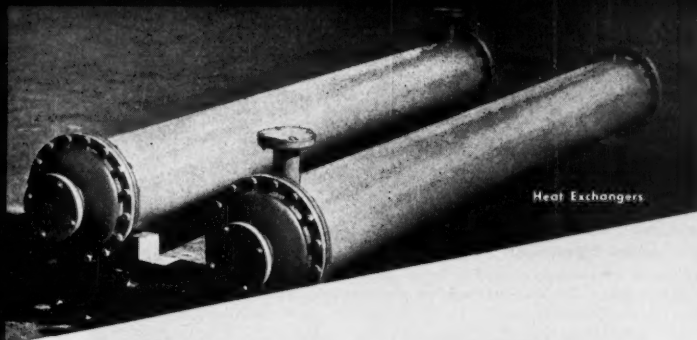
Inner coils are 1 1/2 inch Schedule 80 Grade 8 Ampco Metal Pipe connected with 150 lb. slip-on flanges.

Grade 8 Ampco Metal bolts and Grade 15 Ampco Metal nuts were used throughout.

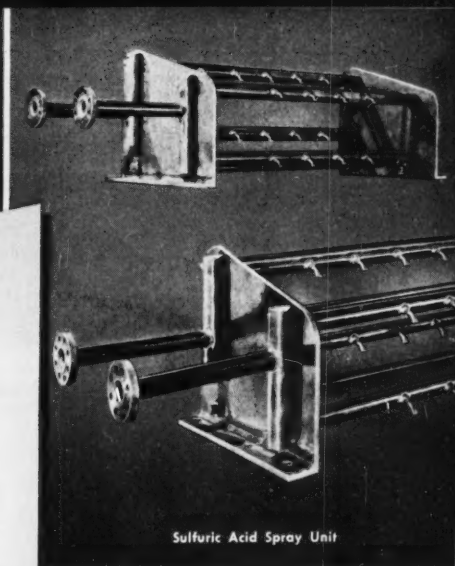
Fabricators: Pacific Coast Engineering Company, Alameda, California.

Ampco Metal sulfuric acid sludge tank in operation at Shell Oil Co.'s Martinez, California plant. Tank is 30 ft. high and 24 ft. in diameter.





Heat Exchangers



Sulfuric Acid Spray Unit



Fabricating Ampco Metal with Inert Gas Consumable Electrode Welding

AMPCO* METAL

to hold Sulfuric Acid Sludge

because it **RESISTS CORROSION**

Yes, Shell Oil Co. and many other refiners and companies in the process industries use Ampco Metal to solve corrosion problems.

Here's why! Ampco Metal Grade 8, one of a series of engineered aluminum bronze alloys, has these unique properties: high resistance to corrosion . . . high tensile strength (75,000 psi) . . . high physicals at extreme temperatures . . . high strength to weight ratio . . . high impact and fatigue values (Charpy @ -423°F., 93 ft. lbs., @ 70°F. 75 ft. lbs., fatigue limit 28,000 lbs. @ 100,000,000 cycles) . . . high resistance to wear from erosion, abrasion, cavitation-pitting . . . high compressive strength (E. L. in Comp. 25,000 psi) . . . high modulus of elasticity (18,000,000) . . . easy to fabricate with Ampco-Trode* welding wire and coated electrodes.

Ampco Grade 8 has Boiler Code Approval and is available in sheet, plate, extrusions, pipe, tubing and fasteners. It may be the solution to your corrosion problems. Consult your nearest Ampco Field Engineer or write us for further information.

Tear out this coupon and mail today!

*Reg. U. S. Pat. Off. Ampco Metal, Inc., Milwaukee, Wisconsin

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Send me information on the application of Ampco Aluminum Bronzes for corrosion-resistant service in the Process Industries.

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PS-7

MONSANTO

CHEMICALS — PLASTICS

FOR YOUR INFORMATION
 Every month Monsanto publishes these pages of pertinent information which may be helpful to you. This issue discusses:
 Rust Prevention Phenol Disodium Phenoxide
 Masking Odors Santomask Isocyanates
 Santolube 70 Solution
 Additional information on any of these subjects will be provided by any Monsanto Sales Office in response to your request by coupon or letter.

New additive for industrial oils inhibits rust

Santolube* 70, a new development by Monsanto Research, solves the problem of rust on ferrous metal parts of turbines and other equipment employing oil in closed systems.

Santolube 70 is effective in concentrations ranging from 0.02% to 0.10%. The lower dosage usually is ample protection in light turbine oils. For more viscous oils where salt water is present, higher concentrations of the additive are recommended.

The new additive has been tested thoroughly, with results proving its efficiency beyond normal operating requirements.

If rusting is a problem with your industrial oils, get the details on Monsanto Santolube 70. Mail the coupon for a copy of the new Monsanto Technical Bulletin No. O-86, which gives test results, typical inspection values and other useful information.

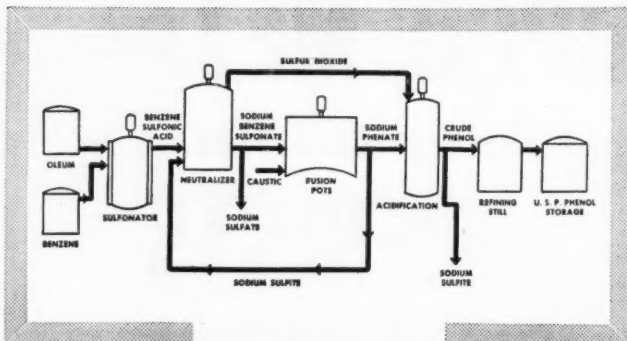
VPI keeps ferrous metals bright

Manufacturers of machinery and weapons are using VPI to protect ferrous metal parts from rusting. They are saving time, money and the mess of coating such parts with heavy grease before shipping. Those who receive the equipment save the time and trouble of cleaning off the grease.

VPI, patented by Shell Development Corporation, includes Monsanto Dicyclohexylamine, which, after chemical reaction, provides corrosion-inhibiting vapors. (Note: VPI is a trade-mark, registered by Shell Development Corporation.)

Here's how VPI works. VPI is a crystalline chemical which slowly vaporizes. The vapor forms an invisible film on steel and other ferrous metals, which resists the corrosive action of moisture and air even under the most unfavorable conditions. If metal parts are properly packaged, this protection lasts for years.

If corrosion of parts in storage or transit is among your worries, mail the coupon for a copy of Monsanto's new booklet which gives complete details.



Flow chart shows how Monsanto makes phenol.

Monsanto a leading producer of phenol

Monsanto's modern facilities for the manufacture of phenol, U. S. P., gives you a dependable source of supply whether you are using the chemical in phenolic resins, as a dye intermediate, or in any of the numerous other applications in which this versatile chemical serves.

Monsanto Phenol, U. S. P., is made to these specifications: Crystalline solid, U. S. P.: White crystalline solid; melt, colorless mobile liquid; solution in water (1:15) clear and colorless; non-volatile residue (100° C.) 0.01% max.; crystallizing point 40.6° C. min. Distillation range: first drop 180.0° C. min.; 100% (first drop to dry point) 2.0° C. max.; 50% to dry point 0.2° C. max.

If you need phenol immediately, contact the nearest Monsanto Sales Office for quotations on the product in 200-pound tins, 450-pound drums or tank cars. Mail the coupon for a copy of the 12-page booklet, "Safe Handling of Phenol."

Phenol serves in these products

Dyes/lufts	Pharmaceuticals
Molding resins	Medicinals
Varnishes	Antiseptics
Enamels	Germicides
Lacquers	Preservatives
Paints	Deodorants
Lubricating oils	Soaps
Textiles (printing)	Vermin exterminators
Explosives	Rubber
Tanning materials	Photographic Chemicals

How to make your product smell...better

If you have a product that pleases your customers in every way except odor, take a look at Monsanto Santomask.* Since 1939, Santomask has been changing objectionable odors into pleasing aromas.

The paint industry, for example, finds that 65 out of every 100 cans of paint are sold to amateur painters. And it found that the amateur painter wants paint with a pleasant odor. To meet this customer requirement, many paint manufacturers

have turned to Santomask... and their products smell better.

The paint industry is only one of the many served by Santomask. It is used in printing inks, adhesives, vinyl film, lacquer coatings and acetate-butylate (plastic) moldings. It has possibilities of usage in many other products. Santomask is compatible with a wide range of materials.

For information on Monsanto Santomask, mail the coupon or contact the nearest Monsanto Sales Office.

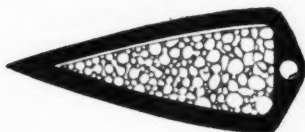
Liquid Germicide Santophen 1 Solution Now Available

Commercial production of Santophen* 1 Solution, a new liquid germicide effective against both fungi and bacteria and consisting of 75 per cent by weight Santophen 1 and 25 per cent isopropanol, has been announced by Monsanto.

Santophen 1 flakes for those who prefer the 100 per cent active material will continue in the Monsanto line. A germicide of substituted phenolic composition, Santophen 1 shows phenol coefficients in the order of 150 to 200 against standard test organisms, and kills fungi in concentrations of .005 to .05 per cent. It is non-irritating in usage dilutions and relatively nontoxic to higher animals, according to company tests.

Santophen 1 has been formulated for a variety of general disinfectant purposes, particularly in hospitals and restaurants.

Foamed-in-place Isocyanate Resins Have Features Valuable to Industry



A new-type foam resin with unusual properties is attracting widespread attention in many industries.

Based on toluene isocyanate, the new light-weight foam resin has unusual characteristics:

- Can be foamed in place. There is no need to shape, fit or transfer finished piece.
- It can be made to stick to surface of cavity in which it is made.
- Density can be varied from three to twenty-five pounds per cubic foot.

Watch this space FOR IMPORTANT NEWS in our next issue about SANTOMERSE Wetting Agent

There will be an important new development in Santomerse* wetting agents. Look for the details in this same space in our next issue. This may be the news that will help you obtain improved quality in your processing.

- Foam bubbles are discontinuous and foam itself is rigid.
- Foam may be filled with inert materials to get a variety of properties.
- Properties of isocyanate foams make them worthy of consideration for electrical and electronic applications.
- Foam has good thermal insulation properties.
- Foam is resistant to water.

These foams give excellent results when used for filling voids in process equipment to exclude moisture or other substances. They also are used to put strength into intricate spaces without the addition of excessive weight; example: aileron and wing tips of aircraft.

You may have an application where the unusual properties of isocyanate foams will be useful.

TWO NEW INTERMEDIATES:

alpha naphthyl isocyanate
diethyl carbamyl chloride

are new part of this established line of products:

toluene di isocyanate
pp' di isocyanato diphenyl methane
phenyl isocyanate
octadecyl isocyanate
ethyl isocyanate
dimethyl carbamyl chloride

For general description see Bulletin P-125.

FOR MORE INFORMATION—Send for new edition of our technical bulletin P-144, "Isocyanate Foamed-in-Place Resins," or write our sales department giving details about specific requirements.

Feed-grade Dicalcium Phosphate Plant in Operation

A new plant for producing dicalcium phosphate, a key ingredient in feeds, has been completed at Trenton, Michigan, and is now in full operation.

From this strategically located plant Monsanto will ship two grades of dicalcium phosphate, 18½% phosphorus and 21% phosphorus. These grades are available for shipment in 100-pound bags or bulk carloads.

Dicalcium phosphate supplemented feeds are popular with stockmen because they contain phosphorus in a form that is virtually 100% available to the animal. In addition, the Monsanto product has the advantage of a carefully controlled composition. There is no variation from batch to batch, shipment to shipment.

Monsanto dicalcium phosphate is also easy to handle. There's no caking and bridging to cause costly slowdowns or stoppages.

If you would like to know more about this product use the coupon.

MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle, Twin Cities. In Canada, Monsanto Canada Limited, Montreal.

*Reg. U. S. Pat. Off.



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SEND LITERATURE:

- ☐ Booklet, "Safe Handling of Phenol."
- ☐ Booklet, "VPI."
- ☐ Technical Bulletin No. O-86, "Santolube 70."
- ☐ Technical Bulletin P-125, "Isocyanates."
- ☐ Technical Bulletin P-144, "Isocyanate Foamed-in-Place Resins."

SEND INFORMATION:

- ☐ Santomask. ☐ Santophen 1 Solution.
- ☐ Santomerse. ☐ Isocyanates.
- ☐ Dicalcium Phosphate.

MONSANTO CHEMICAL COMPANY

1700 South Second Street, St. Louis 4, Missouri

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Company.....

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City.....Zone.....State.....

Continuous Radioactivity Measurements

with the  Counting-Rate Meter

for NUCLEAR RESEARCH ★ CHEMISTRY ★ MEDICINE & BIOLOGY
GEOLOGY ★ METALLURGY ★ AGRICULTURE ★ MINERALOGY

The G-R Type 1500-B Counting-Rate Meter, with Geiger-Mueller Counter, is a complete precision instrument for the continuous visual, aural and graphic measurement of the rate of random radiation. It is basically a laboratory instrument rather than a field survey device.

Four response speeds control meter fluctuations for varying conditions — change in rate of count occurring in a fraction of a second can be recorded or measured accurately — high input

sensitivity permits use of long cable to counter tube — calibration adjustment on panel — accuracy unaffected by $\pm 10\%$ changes in line voltage.

WITH THIS INSTRUMENT the geologist has observed the disintegration of mineral deposits to learn the age of the earth... the metallurgist has compiled valuable data on case hardening, welding and alloying... chemists have studied photosynthesis by tracer techniques... biologists have determined the effects of dosage of food or of medicine on a specific organ, and have applied irradiation selectively... the mineralogist has tabulated the relative abundance of natural radioactive isotopes.

Crystallography, oil surveying, glass and plastic manufacturing, combustion engineering design, ore assaying and turbulence research are but few of the many fields where measurement of radioactivity is proving very valuable.



The Type 1500-B Counting-Rate Meter is being used to drive the Esterline-Angus 5 ma model pen recorder... particularly useful for obtaining a permanent graphical record of changes in rate. Visual and aural indication of radiation intensity are provided by panel meter and loud speaker.

ABRIDGED SPECIFICATIONS

Range: full-scale values of 200, 600, 2000, 6000 and 20,000 counts per minute — minimum rate readable on meter scale is 5 counts per minute

Pre-amplifier: built into hand probe at end of 6-foot cable — adapter permits use of either self-quenched or internally quenched counter tubes of any design

Accuracy: $\pm 3\%$ of full scale

Response: Four response speeds for wider range of meter damping

Counter Circuit Voltage: continuously variable from 400 to 2,000 volts, and available at rear of instrument — can be read from 8-position switch and calibrated dial — means provided for standardizing voltage

Output: trigger circuit output — recorder jack on front panel

Accessories Supplied: plug for connecting recorder, counter tube adapter, line cord and spare fuses (counter tubes extra)

Type 1500-P4 Beta-Gamma-Ray Counter Tube \$40

Type 1500-P5 Beta-Gamma-Ray Counter Tube \$50

Type 1500-P11 Probe Mounting Stand... \$12.50



GENERAL RADIO Company

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90 West St., NEW YORK 6 • 929 S. Michigan Ave., CHICAGO 5 • 1090 N. Seward St., LOS ANGELES 33



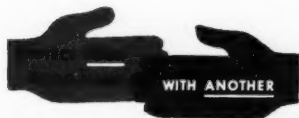
...for clean performance

The motor carrying a Fairbanks-Morse seal is your assurance of long, dependable service . . . the *best* in motor performance.

Why? In totally enclosed, fan-cooled motors, for example, Fairbanks-Morse brings you symmetrical dual-end ventilation, an exclusive feature that speeds cooling, eliminates "hot-spot" dangers . . . complete protection of vital parts from dust, chips and corrosive gases . . . for clean performance in the dirtiest locations.

Whatever the drive problem on your equipment, you'll find the one motor best suited to that application in the complete Fairbanks-Morse line.

When you look for electric motors . . . look for the Fairbanks-Morse seal. For over 120 years it has stood for the finest in manufacturing integrity—to *all* industry. Fairbanks, Morse & Co., Chicago 5, Ill.



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ELECTRIC MOTORS AND GENERATORS • MAGNETOS • DIESEL LOCOMOTIVES AND ENGINES
PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY



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VICTOR AMMONIUM PHOSPHATES OUTSTANDING FLAMEPROOFING AGENTS

Victor monoammonium and diammonium phosphate, the Fyrex® group, and Victamide* are doing things for industry. From matches to building materials, manufacturers will tell you that the ammonium phosphates are the most efficient flameproofing agents known for their products. These busy chemicals are used extensively to flameproof paper, wood, textiles, and vegetable fibers. Victor monoammonium phosphate is used to prevent afterglow in matches.

FROM FOOD TO FABRICS

Victor ammonium phosphates are truly versatile compounds and improve many products and processes. They are applied successfully to the manufacture of many food products. Victor monoammonium phosphate is used as an ingredient in plant foods, as a cleaner and rustproofing agent for metals, and as an ingredient in glass and vitreous enamels. Victor diammonium phosphate is used in the formulation of ammoniated dentifrices, as a catalyst for urea and melamine resins, in the manufacture of chemicals, and in the dyeing of textiles.

ATTENTION CHROME DYERS OF WOOL!

Victor diammonium phosphate can save you as much as *four* hours in dyeing time . . . help you save on labor and production costs.

Victor diammonium phosphate is a unique and valuable chrome-dyeing assistant in that it provides the desirable initial pH which persists while the bath is brought to boil. Upon continued boiling, the pH falls gradually, allowing ample time for proper distribution of the dye.

(*U.S. Pat. 2122122)

Victor diammonium phosphate prevents wide fluctuations in pH, promotes unusual levelness, and makes chrome dyeings more easily reproducible.

Mail the coupon for technical bulletin and sample.

PROBLEMS SOLICITED . . . AID AVAILABLE

A good look at the information on the following page could be your first step in finding something new for your company. There is that possibility. Experimental samples and additional information on Victor ammonium phosphates are available. Mail the coupon. Our research and development staff welcome the opportunity to work with you. Please attach the coupon to your company letterhead.

HOW INDUSTRY PROFITS FROM VICTOR PHOSPHATES

More and more, industry is turning to the growing Victor phosphate family to help do many jobs better and at lower cost. At Victor, new chemicals and new uses are being discovered continually. Upon investigation, you may find that one or more of these versatile chemicals can solve an important product or process problem for you . . . give your company the opportunity to increase efficiency, lower costs, and further improve product.

VICTOR . . . THE DEPENDABLE NAME IN CHEMICALS

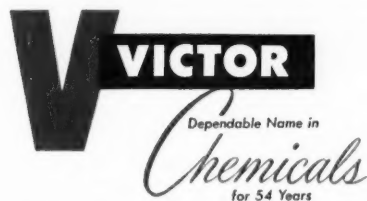
As a manufacturer of industrial chemicals, Victor is recognized for dependability . . . dependable research, dependable standards of manufacture, dependable product quality, and dependable service to customers. Victor's multiple plant facilities and technical assistance to industry are unmatched in the phosphate field. Most definitely, users have come to know Victor as *the* dependable name in chemicals . . . a thought that will serve you well when selecting a source of supply.

VICTOR CHEMICAL WORKS		NAME _____ TITLE _____	
141 West Jackson Boulevard, Chicago 4, Illinois		COMPANY _____	
Please send without cost or obligation:		STREET _____	
<input type="checkbox"/> Sample of Monoammonium Phosphate	<input type="checkbox"/> Sample of Diammonium Phosphate (Chrome Dyeing Technical Bulletin)	CITY _____ ZONE _____ STATE _____	
<input type="checkbox"/> Sample of Fyrex®	<input type="checkbox"/> Sample of Flexible Fyrex®	(Fill in and attach to company letterhead)	
<input type="checkbox"/> Sample of Special Flexible Fyrex®	<input type="checkbox"/> Sample of Victamide		
<input type="checkbox"/> Additional Information	<input type="checkbox"/> Victor Catalog		

IMPORTANT PROPERTIES OF

VICTOR FOOD-PURITY AMMONIUM PHOSPHATES

	MONOAMMONIUM PHOSPHATE	DIAMMONIUM PHOSPHATE																																																									
Formula Mol. Wt. Spec. Gravity	(NH ₄) H ₂ PO ₄ Monoammonium Phosphate is a brilliant, 115.08 white crystalline or powdered material meeting all U. S. Pure Food Law requirements. 1.803	(NH ₄) ₂ HPO ₄ Diammonium phosphate is a brilliant 132.07 white crystalline or powdered product complying with all U.S. Pure Food Law requirements. 1.619																																																									
Typical Analysis	Phosphorus Pentoxide (P ₂ O ₅)..... 61.3% Ammonia (NH ₃)..... 14.6% Sulfate (SO ₄)..... 0.02 Iron (Fe)..... 35.0 ppm Fluorine (F)..... 2.5 ppm Arsenic Oxide (As ₂ O ₃)..... 0.2 ppm Lead (Pb)..... 0.3 ppm pH (1% solu.)..... 4.5	Phosphorus Pentoxide (P ₂ O ₅)..... 53.5% Ammonia (NH ₃)..... 25.2% Sulfate (SO ₄)..... 0.06% Iron (Fe)..... 38.0 ppm Fluorine (F)..... 1.8 ppm Arsenic Oxide (As ₂ O ₃)..... 0.1 ppm Lead (Pb)..... 0.3 ppm pH (1% Solu.)..... 8.0																																																									
Granulation	Regular—All through 10 mesh Powdered 99% Powdered Monoammon. Phos. substantially all through 100 mesh. 1% Tricalc. Phosphate as conditioner.	Regular—Substantially all through 10 mesh. Powdered FF—Substantially all through 100 mesh. (Powdered Diammonium Phosphate contains 0.5% Tricalc. Phos. as conditioner.)																																																									
Solubility	Grams. NH ₄ H ₂ PO ₄ per 100 grams of: <table> <tr> <th>T° C.</th><th>Sat. Sol.</th><th>Water</th></tr> <tr><td>0</td><td>18.5</td><td>22.7</td></tr> <tr><td>10</td><td>22.8</td><td>29.5</td></tr> <tr><td>20</td><td>27.2</td><td>37.4</td></tr> <tr><td>30</td><td>31.7</td><td>46.4</td></tr> <tr><td>40</td><td>36.2</td><td>56.7</td></tr> <tr><td>60</td><td>45.2</td><td>82.5</td></tr> <tr><td>80</td><td>54.2</td><td>118.3</td></tr> <tr><td>100</td><td>63.4</td><td>173.2</td></tr> <tr><td>110.5</td><td>68.3</td><td>215.0</td></tr> </table>	T° C.	Sat. Sol.	Water	0	18.5	22.7	10	22.8	29.5	20	27.2	37.4	30	31.7	46.4	40	36.2	56.7	60	45.2	82.5	80	54.2	118.3	100	63.4	173.2	110.5	68.3	215.0	Grams (NH ₄) ₂ HPO ₄ per 100 grams of: <table> <tr> <th>T° C.</th><th>Sat. Sol.</th><th>Water</th></tr> <tr><td>0</td><td>30.0</td><td>42.9</td></tr> <tr><td>10</td><td>38.6</td><td>62.8</td></tr> <tr><td>20</td><td>40.8</td><td>69.0</td></tr> <tr><td>30</td><td>42.9</td><td>75.2</td></tr> <tr><td>40</td><td>45.0</td><td>81.8</td></tr> <tr><td>50</td><td>47.2</td><td>89.2</td></tr> <tr><td>60</td><td>49.3</td><td>97.3</td></tr> <tr><td>70</td><td>51.4</td><td>106.0</td></tr> </table>	T° C.	Sat. Sol.	Water	0	30.0	42.9	10	38.6	62.8	20	40.8	69.0	30	42.9	75.2	40	45.0	81.8	50	47.2	89.2	60	49.3	97.3	70	51.4	106.0
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Uses	Flameproofing of paper, textiles, wood and vegetable fibers. Prevents afterglow in matches. An ingredient of plant nutrients. Manufacture of yeast, vinegar, yeast foods, bread improvers. As an acid cleaner and rust-proofers for metals. As an ingredient in glass and vitreous enamels.	Its flameproofing properties and uses are similar to those for monoammonium phosphate. In the formulation of ammoniated dentifrices. To control the pH of soda crackers—U.S. Pat. 2288118. As a catalyst for urea and melamine resins. As a buffer in the chrome dyeing of wool. In the manufacture of high purity calcium phosphates for use in phosphors.																																																									
Availability	Commercial Quantities.	Commercial Quantities																																																									
Packages	Multiwall Paper Bags—100 pounds net.	Multiwall Paper Bags—100 pounds net.																																																									



VICTOR CHEMICAL WORKS

141 West Jackson Boulevard, Chicago 4, Illinois

A. R. Maas Chemical Co., Division
4570 Ardine Street, South Gate, Calif.

	% Monoammon. Phosphate	% Diammon. Phosphate	pH of 0.5% Soln.
100	100	0	4.5
80	80	20	6.2
60	60	40	6.6
40	40	60	6.9
20	20	80	7.2
0	0	100	8.0

Fyrex® is a substantially neutral phosphate of ammonia in fine crystalline form.

Flexible Fyrex® is also a neutral product to which a variety of softening agents has been added to prevent material from adhering to drying rolls, plates, or forms, and to preserve flexibility of materials.

Special Flexible Fyrex® provides rapid penetration of its solution for materials which are difficult or slow to wet and in addition preserves the flexibility of the treated materials by inhibiting the crystallization of ammonium phosphate.

Solubility: Approximately 54 parts in 100 parts saturated solution at 26.5° C.

Uses: Flameproofing of textiles, paper, wood, vegetable fibers.

Applied to paper, fabrics, or insulating materials by dipping, spraying, or contact rollers; to wood under pressure in autoclaves.

Containers: 100 lb. paper bags

GUARANTEED

to SATISFY the user

THE ARMSTRONG GUARANTEE

Every Armstrong Trap is unconditionally guaranteed to be free from defective workmanship or material, to function perfectly, to fulfill all claims in every respect, and to give complete satisfaction.

NOT FOR ONE YEAR, not for two years, but for *life* are Armstrong Traps guaranteed against defects. Not under qualifying conditions, but with *no strings attached*, are Armstrong Traps guaranteed to give satisfactory performance.

Only a good steam trap could possibly be backed by such a guarantee. Here are some of the reasons the Armstrong Guarantee is possible:—

① **EXPERIENCE.** Armstrong, in business since 1911, originated inverted bucket traps and has built far more than anyone else.

② **SERVICE.** Armstrong traps and parts are carried in stock at more than 100 points in the United States. Complete repair and overhaul service is available in principal centers. Armstrong Representatives are factory-trained to give you unequalled assistance on trap selection, installation, maintenance and troubleshooting problems. Armstrong literature gives you reliable, usable data on all phases of trapping.

③ **DESIGN.** Armstrong traps offer an optimum relationship between bucket weight, leverage, lever travel and orifice size to give big capacity in a small trap and assurance that the valve will open and close properly under adverse operating conditions.

The patented free-floating "frictionless" leverage system reduces wear to a vanishing point, prevents sticking. The swirling action of condensate down under the bucket, up and out through the orifice, scrubs the trap clean of ordinary dirt and scale.

④ **QUALITY.** The valves and seats in Armstrong traps are chrome steel, hardened, ground and lapped in mated sets to a steam-tight fit. All other working parts are corrosion-resistant, wear-resistant stainless steel. You get mechanisms in low and medium pressure traps that are identical in design, materials and workmanship to those in traps for 900°F, 950 psig. Every Armstrong trap, not just an occasional one, is inspected and tested before shipment.

You cannot go wrong when you specify "traps shall be Armstrong!" For the name of your Armstrong Representative write:

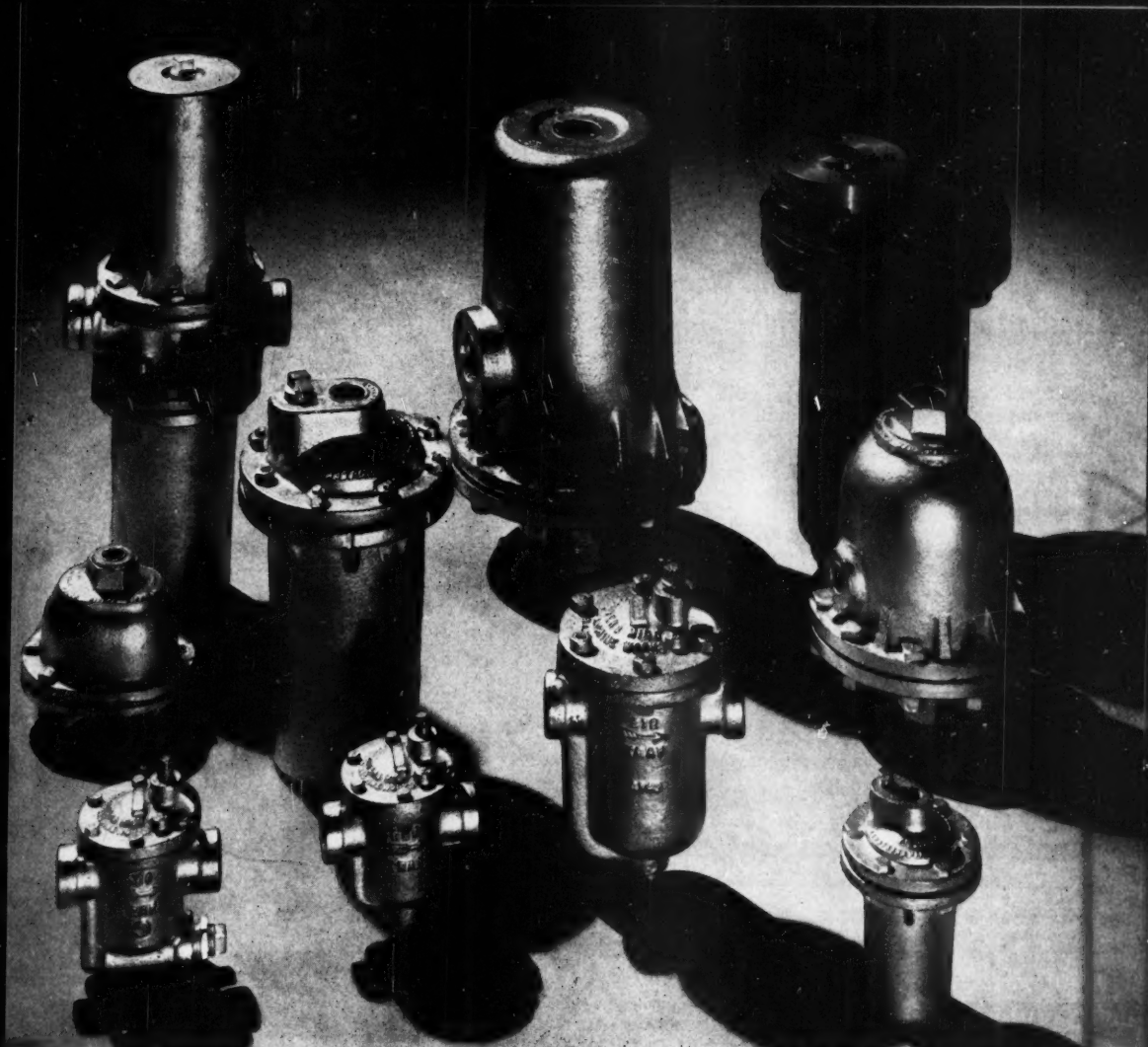
See Our Exhibit
National Power Show
Grand Central Palace
New York
December 1-6

ARMSTRONG MACHINE WORKS

858 Maple Street, Three Rivers, Michigan



ARMSTRONG



Guaranteed Armstrong Products

- Cast semi-steel inverted bucket steam traps for pressures to 250 lbs. Side inlet-side outlet or bottom inlet-top outlet body styles. Catalog J.
- Forged steel inverted bucket steam traps for pressures to 2400 lbs. Screwed, flanged or socket weld connections. Catalog J.
- Compound steam traps, cast or forged bodies, for big condensate loads up to 300,000 lbs/hr continuous. Bulletin 215.
- Ball float air and air relief traps for automatic discharge of water from gas, or gas from water. Bulletin No. 2021.
- Dual gravity traps for discharging water from a light liquid. Bulletin No. 209.

FREE A 44-Page Manual on Good Trapping Practice

The Armstrong Steam Trap Book, Catalog J, gives complete data on Armstrong steam traps, covers trap selection and calculation of condensate loads for nearly every type of steam heated equipment. Trap installation, maintenance, troubleshooting and repair parts data are also included. Free on request, without obligation.



STEAM TRAPS

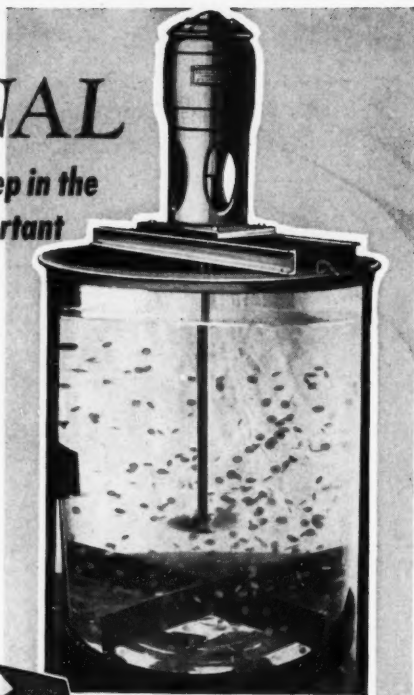
SATISFACTION
or your
money back

Announcing a New INTERNATIONAL

headline achievement—a truly sensational step in the science of Chemical Mixing—a new and important concept in the field of Fluid Agitation . . .

The INTERNATIONAL STABILIZER-BAFFLE stems from International's pioneering research in the Science of Mixing as a basic Chemical Engineering Unit Operation. • It prevents ineffective mass rotation and creation of a liquid vortex. • It induces top-to-bottom turnover instead of non-useful horizontal swirl. • It is an anti-settling and anti-layering device, improving the flow pattern produced by helical propeller type mixing elements.

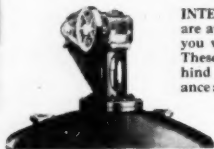
The INTERNATIONAL STABILIZER-BAFFLE eliminates the whipping of free-end suspended vertical mixer shafts, with no appreciable side thrust exerted on the shaft. It prevents shaft failures which would otherwise occur from critical speed considerations. It makes possible the use of long thin shafts, up to 10 ft. in length, without the use of steady bearings or step bearings. It eliminates the need for submerged bearings with their attendant maintenance and repair problems. Consumes little space and need not rest on the bottom of tank. Thus, there is not the usual "dead" volume as with ordinary tank baffles. It can be readily removed for cleaning purposes, if necessary. Informative Literature sent on request.



The International STABILIZER BAFFLE ELIMINATES MIXER SHAFT WHIP—AND LIQUID VORTEX

INTERNATIONAL MIXERS are now being used throughout the world for all industrial applications. They are available in all metals and coatings and for all power sources or current characteristics.

INTERNATIONAL sales engineers are available in your area to help you with your mixing problems. These sales engineers are right behind the International performance and workmanship guarantee.



These two photographs illustrate the startling difference in flow pattern, occurring with and without the INTERNATIONAL STABILIZER BAFFLE, under exactly the same conditions. The shaft speed, propeller and rheological properties of the mix being the same in both cases . . . Impeller is center-mounted operating Counterclockwise at 1750 RPM. Turnover and overall Agitation in above photograph is effected by splitting of helical stream, causing the flow to follow a radial path to the tank wall, and thence upward.



Above photograph shows the deep vortex and poor solids distribution, without the INTERNATIONAL STABILIZER BAFFLE. Note that there is little top to bottom turnover and inefficient flow pattern.

INTERNATIONAL ENGINEERING, INC.

NEW YORK
15 PARK ROW
WORTH 2-2580

DAYTON 1, OHIO

CHICAGO
407 S. DEARBORN
WABASH 2-0733

MEMO

INTERNATIONAL ENGINEERING, INC.
DAYTON 1, OHIO

- ☐ TECHNICAL SUPPLEMENT No. 111
ON STABILIZER-BAFFLE
- ☐ CATALOG 74 ON
PORTABLE MIXERS

Please send literature checked below:

☐ CATALOGS 73 & 76 ON TOP AND
SIDE ENTERING AGITATORS

☐ CATALOG 120 ON CHEMICAL
PROCESSING EQUIPMENT

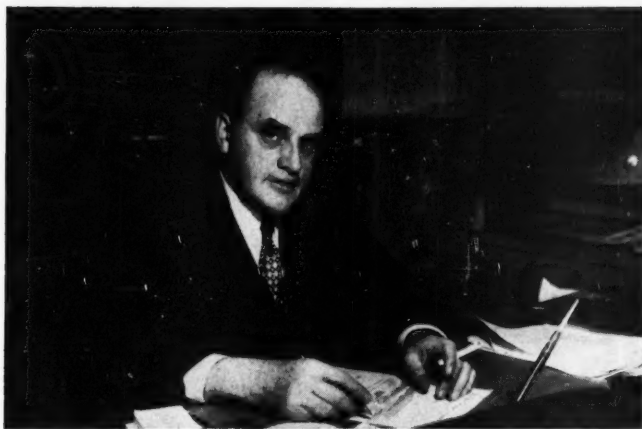
Name _____

Title _____

Company _____

Address _____

Memo from the Editor John R. Callahan



Our Jim Blackburn

Back in 1925 a young mechanical engineer started to work for McGraw-Hill. Although barely two years out of Rensselaer Polytech, he was imbued with the idea that he could apply his engineering education in selling subscriptions to technical publications.

He was given a tryout handling direct mail solicitation for this magazine and our sister journal, *Engineering News-Record*. The young man's ideas and methods clicked almost from the beginning. He not only talked our language, but he seemed to sense the reading habits and needs of chemical engineers in the process industries.

Two new publications, *Food Industries* and *Construction Methods* were added to his list, but he was soon reaching for even more customers for his mailorder laboratory. From manager of the mail sales division, he was promoted to head the Circulation Department which now has 25 domestic and 8 foreign publications.

Today James E. Blackburn, Jr., RPI '23 is vice president and director of both McGraw-Hill Publishing Co. and McGraw-Hill International. More than 800 men and women working under his direction serve more than a million readers. His department checks, records, classifies and handles

5,000,000 documents a year. Annual mailings will total 12,000,000 to 15,000,000 letters.

Yet because Jim Blackburn is a good organizer and coordinator, he seems to find time for some important extracurricular activities. I'm told he plays a good game of golf. From sorry experiences over a span of years I can testify to his prowess in bridge, gin rummy and poker.

But of more interest to *Chemical Engineering* readers and advertisers is James E. Blackburn's activities as a director since Oct. 16, 1947, of the Audit Bureau of Circulations.

Here he is applying his engineering methods and principles to the 370 business paper members of ABC who, through their membership, have pledged themselves to eliminate guesswork in their circulation records and methods. Since that affects you as the reader who calls the turn on the editorial content of this magazine, let's have a look at the inner workings of the organization that's behind the familiar ABC symbol.

Your Bureau of Standards

Back in the early days there were no generally accepted means of measuring circulation. There were no standards of circulation value. The honest publisher was never able to disprove the

claims of an unethical competitor. The advertiser had no way of knowing who read what publications, whether they were paid for or sent free.

So a group of publishers and advertising men, recognizing the need for dependable facts and figures on circulation, got together and formed a cooperative association which they called the Audit Bureau of Circulations.

At least once a year, ABC's highly trained auditors come into our Circulation Department to spend several weeks. When they leave, they give us a detailed, accurate, verified record of all of you (some 37,500) who pay to receive *Chemical Engineering* at your home or office. We, and all the world, know where you work and who you are in terms of your title and, consequently, of your job interests. This information is obviously of great value to the advertiser who would reach and serve a specific market.

But perhaps it is less obvious how ABC standards of circulation are behind-the-scene forces that make for editorial quality.

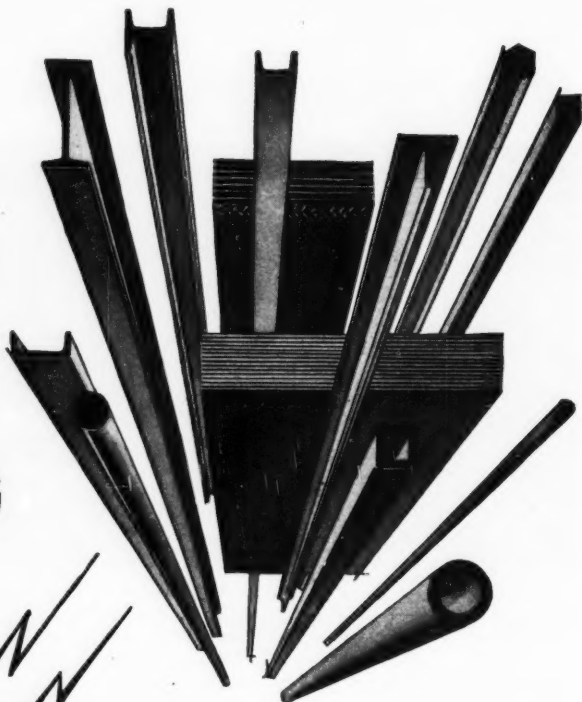
You, as a reader, have indicated that you want us to serve you, that you are willing to pay for that service as long as we meet your needs. We in turn have signed a contract with you, as a subscriber, to deliver a specific number of issues of a specific editorial character at a specific price. You have the say as to whether or not we stay in business. Our very existence depends on your continued acceptance.

That is why the ABC audit is our invaluable guide in selecting and publishing the editorial content of this magazine. And ABC is your "Bureau of Standards" in making sure you get your money's worth.

So we on *Chemical Engineering* are proud to have been a member of the Audit Bureau of Circulations since its inception. And through our Jim Blackburn we hope we have contributed to its sound engineering methods and operations.

Sidney F. Kirkpatrick

STEEL for CHEMICAL PROCESSING



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When you call Ryerson for steel, you can be sure of prompt, personal service from the minute your call comes in. With the exception of those few items remaining in short supply, we can fill all your orders quickly from stock on hand. And to assist you on any problem of steel procurement, application or fabrication, the friendly counsel of experienced Ryerson specialists is always yours for the asking.



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Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

OCTOBER 1952

Double Jeopardy: Scientist or Engineer?

Strangely enough, there was no substantial increase in the scientific content of the major engineering courses between the two world wars. Our authority is Dean S. C. Hollister of Cornell. He cites this as one of the reasons so many scientists assumed positions of leadership in the war program.

Prof. Gordon Brown of M.I.T. raises the question: Is science now the master rather than the servant of engineering? Director C. C. Furnas of the Cornell Aeronautical Laboratory replies with a personal inquiry: If you're sick, would you prefer to call a doctor or depend on the advice of a research scientist in medicine?

Exchanges such as these did much to enliven the first joint meeting in Chicago last month of the Engineers' Council for Professional Development with the American Society for Engineering Education. From opposing—often clashing—viewpoints we got the impression that some revolutionary changes in engineering education may be in the making. For the first time we found the ECPD accrediting program being challenged on the basis that its standards promoted duplication and overlapping of educational facilities.

We were told that individuality has been lost in certain areas of the country as competing institutions rush to get aboard the ECPD-approved lists. Fewer colleges have held out for basic scientific courses in the face of the popular demand for more humanistic and social studies. Yet we find an increasing number of representatives from industry who contend that the modern engineer should be educated as a scientist rather than as a practitioner. They say that the scientist is more versatile than the engineer, can better be trained in industry for the practical application of basic principles.

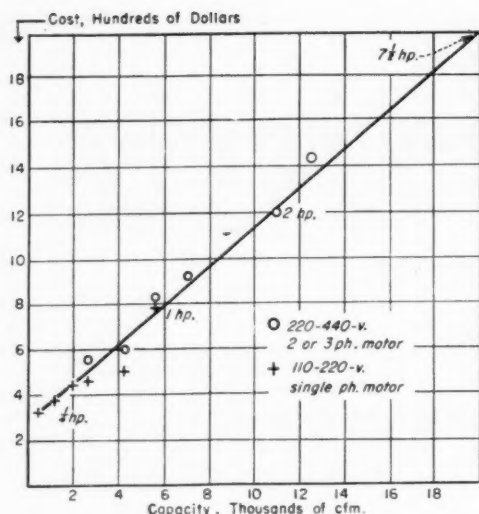
Such controversy, in our opinion, is stimulating and wholesome. There should be no freezing of curricula, no rigid standards to be followed blindly in training

engineers for industry. Yet we cannot help but feel that chemical engineering is open to less criticism on this score than are the older branches of engineering. There always has been a higher content of basic sciences in its curricula. A larger proportion of its graduates go into research and development work where there are fewer fixed borders between scientists and engineers. And World War II surely demonstrated the versatility and resourcefulness of chemical engineers in tackling the widest range of problems.

Of course, we should not neglect the training of specialists. They are needed, as never before, in leading the attack into new fields of science and technology. But because many more engineers are needed in management and administration, we would argue for specialization only in the graduate schools. The four-year course must continue to lay the basic foundation for further training, at the same time turning out a well-balanced product for industry.

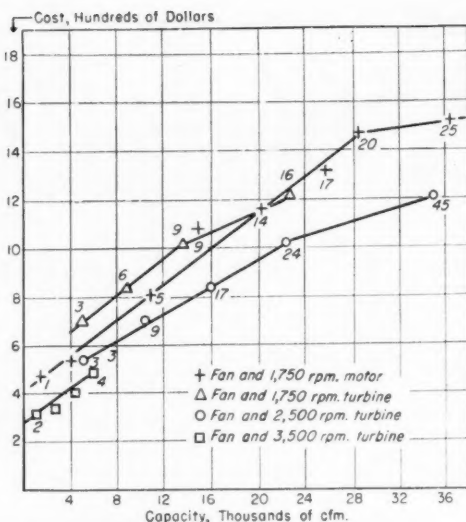
Despite the protective provisions of the Constitution of the United States, chemical engineers continue in double jeopardy. We are judged as scientists for any failure to appreciate and understand the basic laws and principles on which our technology is founded. We are judged as engineers for any shortcomings that may develop in our useful applications of the underlying sciences of chemistry, physics, and mathematics. We are not cook-book engineers. Nor do we aspire to any such corny title as "Scientists." But from its very origin and subsequent development, chemical engineering seems to offer most opportunity for the double role of scientist and engineer.

Sidney D. Kirkpatrick



AXIAL FLOW DRAFT INDUCERS

Maximum capacity ratings are plotted at 0.5 to 1.0 in. S.P. and 1,750 rpm.



AXIAL FLOW DRAFT BLOWERS

Capacities are plotted at 2 in. S.P. Numbers on curves represent bhp.

Blower and Fan Costs

Here is easy-to-use cost information for three basic types of air moving equipment. Standard costs are plotted against capacity. Accessory and modification costs are covered in text.

RUDOLPH E. DENZLER

Common use is made of the expression "free as air" wherever men discuss costs. To the chemical engineer, who utilizes air as a vital material, such a phrase does not ring true. Certainly the source is free but energy must generally be expended to move atmospheric air as required for its utilization.

Mechanical work for moving air is applied through the use of fans and blowers. These devices find widespread use throughout the chemical process industries in supplying air for ventilation, combustion and process requirements. With this in mind cost data have been gathered on several types of air moving equipment.

The cost information presented on these pages deals with three basic

types of equipment:—Axial flow propeller fans and blowers; radial flow centrifugal fans and blowers; and positive rotary blowers, gas pumps and compressors. Graphical plots are shown for standard conditions and costs. The text offers additional cost information on equipment extras.

AXIAL FLOW DRAFT INDUCERS

These fans are used in lieu of stacks for producing draft on building heating boilers. Normal mounting position is either in place of an elbow in the breeching or on top of the exhaust stack.

The cfm. figures used for plotting represent the maximum rating for each different sized unit. These ratings are for 0.5 in. of water static pressure (S.P.) on the small fans up to 1.0 in. S.P. on the larger ones. Each 1,000 cfm. of capacity will handle the stack gas produced in burning 10 gph. of oil, 125 lb. per hr. of coal,

or 2,000 cfh. of gas rated at 1,000 Btu. per cu. ft.

Prices shown on the graph are net quoted in March 1952 and include:

- Fan and housing.
- Fully enclosed multispeed motor.
- Manual speed controller.
- Heat insulation for fan and housing.

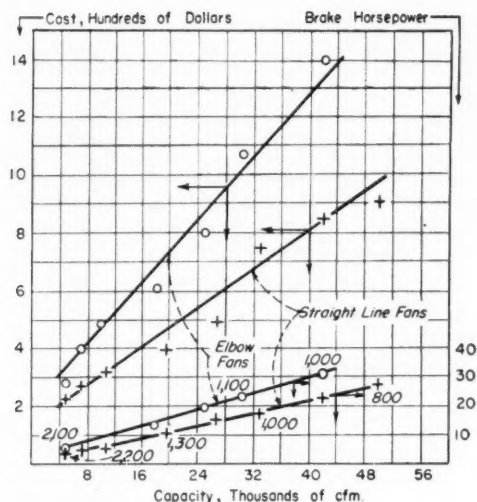
Price Modifications—The choice between breeching or chimney mounting will have little effect on the cost. However, cost will be altered as noted by the following:

- For angle or double side inlet, add 10 percent.
- For chimney cap and discharge hood the cost increase ranges from 20 percent on small units to 10 percent on larger ones.

AXIAL FLOW DRAFT BLOWERS

Propeller blowers used for producing boiler draft are roughly cylindri-

RUDOLPH DENZLER compiled these cost data while holding an assistant professorship at Stevens Institute of Technology.



AXIAL FLOW DUCT FANS

Capacities are shown for 2 in. S.P. Numbers on bhp. curves refer to fan speeds.

cal with diameters from 14 to 40 in. and lengths approximately equal to diameter. Boiler draft blowers of this type, having either motor and/or turbine drives, can operate from 0.5 to 3.0 in. S.P. up to 10 hp. and up to 5.0 in. S.P. above 10 hp.

The various capacities which have been plotted are at 2 in. S.P. and several blower speeds. Variations in capacity for the same blower speed at static pressures other than 2 in. are shown in the following table:

Static Pressure, In. of Water	Percent Change in Rated Cfm. at 1 Hp.	Percent Change in Rated Cfm. at 5 Hp.	Percent Change in Rated Cfm. at 25 Hp.
0.5-1	+33	+15	+10
3	-50	-25	-10
5			-25

Blower speed can be altered to vary capacity at any given static pressure. Motor drives, for instance, can be furnished for either 1,750 or 1,150 rpm. However, operation at a blower speed of 1,150 rpm. is not generally recommended at more than 2 in. S.P. At any given pressure below 2 in. a blower rotating at 1,150 rpm. will pump $\frac{3}{4}$ the cfm. at $\frac{1}{4}$ the bhp. required for 1,750 rpm.

Turbine drives for large blowers can run at speeds from 1,700 to 2,700 rpm. Smaller turbines and blowers can operate in the range from 2,500 to 4,000 rpm. Capacity on small units varies as the 1.7 power of the speed; large units as the 1.2 power.

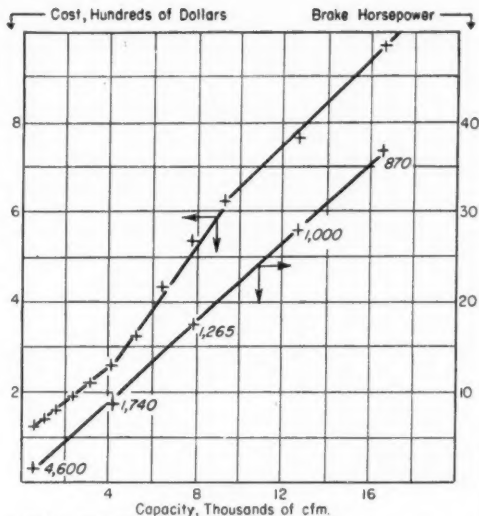
Costs plotted on the graph are net quoted for March 1952 including motor and/or turbine. The motor costs which are included cover 1,750 rpm. motors for 60 cycle, 2 or 3 phase, 440- or 550-v.

Price Modifications.—Equipment extras affect the final cost as follows:

1. Flanged unit for horizontal mounting on duct or windbox—negligibly cheaper.
2. Same construction for vertical mounting—add 7 percent.
3. Multi-vane damper, with capacity governor, increases cost \$650 to \$850 according to the blower size.
4. Same without governor adds \$350 to \$450 to the cost.
5. Steel turbine for operation on 600 psi. steam rather than 275 psi.—add \$300 (all sizes).
6. Turbine overspeed trip governor—\$200 extra for all sizes.
7. Turbine steam strainer, relief valve and mounting feet increases cost \$50 to \$200 according to size.
8. Where a combined motor-turbine drive on the same blower is required, the total cost, including a multi-vane damper, is the sum of the cost of a motor driven and a turbine driven blower plus 10 percent.

AXIAL FLOW DUCT FANS

The function of these propeller fans is to move air through ducts at



RADIAL FLOW EXHAUST FANS

Graph shows capacity ratings at 8 in. S.P. Fan speeds are shown by numbers on the bhp. curve.

static pressures from $\frac{1}{2}$ to 2 in. of water. Units are fabricated for either straight line or elbow mounting with the motor mounted outside the air stream.

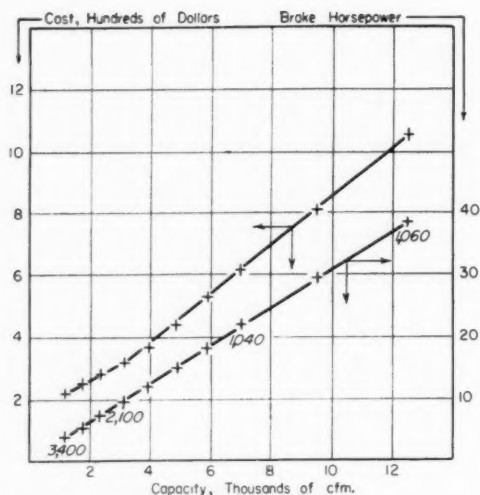
Straight line units for horizontal or vertical mounting range from 2 to 5 ft. in diameter and are approximately one diameter in length. Elbow fans have intakes and outlets from 1 to 5 ft. in diameter and a total length about twice the intake diameter. The fanwheel shaft is usually horizontal but inlets can be turned in any desired direction.

Capacity figures used in the graphical plot are normal at 2 in. S.P. for any given unit. Actually the various fan sizes can be run from $\frac{1}{4}$ to $1\frac{1}{4}$ times the plotted cfm.

Costs depicted on the graph are net quoted in March 1952 for bare fans without motor or extras. In general to price a motor the speed and bhp. must be known.

Variable fan speed can be obtained with a belt drive over a speed ratio range between motor and fan of 1:1 to 3:1. Fan rpm. varies precisely as the cube root of bhp. Using this relationship with the graph and suitable sheave ratios, the motor speed can be determined.

The following table, based on a manufacturer's detailed charts for cfm.-S.P.-bhp., gives approximate bhp.



RADIAL FLOW PRESSURE BLOWERS

Data are plotted for operation at 12 in. S.P. Numbers on the bhp. curve give blower speeds.

values at various capacity-pressure conditions:

Capacity, Multiple of Plotted Cfm.	Pressure, In. of Water	Horsepower, Multiple of Plotted Bhp.
1.	2.	1.
1.5	0.5	1.
1.	0.5	0.5
0.5	0.5	0.17
1.5	less than 0.5	almost 1.
1.	less than 0.5	almost 0.5
0.5	less than 0.5	almost 0.17

Price Modifications—On straight line duct fans, weatherproof construction increases cost from 10 percent for small fans to 20 percent for large ones.

Added costs for elbow fans are:

1. Motors—25 to 35 percent going from small to large motors when using 3 phase, 60 cycle, 220- or 440-v. units at light or medium rating. Where fans work near peak rating motor price adds 35 to 45 percent to total cost.
2. Weatherproof housing—15 percent on direct drives, 30 percent on belt driven units.
3. Vertical shaft—10 percent.
4. Double inlet—8 percent.
5. V-belt drive arrangement, pulleys and shaft not included—5 percent.

RADIAL FLOW EXHAUST FANS

These centrifugal fans, ranging in size from 1 to 6 ft. in diameter by 0.5 to 2.5 ft. thick, can be used for static

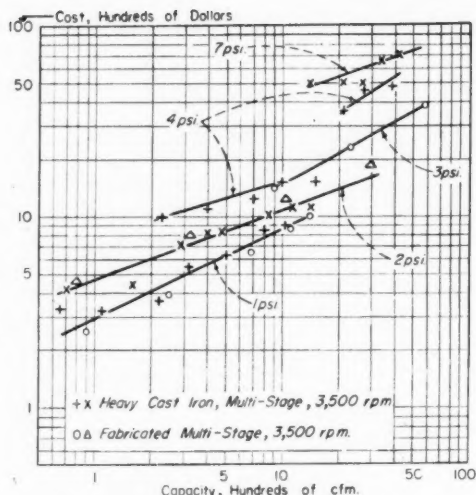
pressure differentials from $\frac{1}{2}$ to 15 in. of water. Housings are constructed of sheet or plate and wheels are cast or fabricated according to required rim speed.

Typical capacity figures at 8 in. S.P. were used in plotting the graph. The efficient range of cfm. ratings for any one fan varies from about one half to double that shown by the graph.

Plotted costs for March 1952 cover bare fans including wheel, casing and motor base for direct drive, without motor. To estimate motor and drive cost see note on same under centrifugal pressure blowers.

Price Modifications—The prices shown will hold for any fan operating in the indicated static pressure range. The following construction variations will cause the noted price adjustments:

1. Mechanical Variations.
 - a. Shaft and ring-oiling bearings for pulley drive but without pulley—cost as shown.
 - b. Same as (a.) but with roller bearing—multiply by 1.05.
 - c. Extended motor base, two ring-oiling bearings and solid coupling for connecting motor, motor not included—multiply by 1.4.
 - d. Closed (shrouded) fan wheel—multiply by 1.05.
2. High temperature service (standard mechanical arrangement only).



RADIAL FLOW HIGH PRESSURE BLOWERS

This graph shows costs for 3,500 rpm. multi-stage cast-iron or fabricated blowers at several pressures.

- a. Temperatures to 550 deg. F.—multiply by 1.2.
- b. Temperatures from 550 to 900 deg. F.—multiply by 1.4.
- c. Temperatures from 900 to 1,400 deg. F., units made of stainless steel, not insulated—multiply by 3.5.
- d. Same as (c.), but insulated—multiply by 4.0.
3. Special protective coatings for wheel and housing.
 - a. Galvanized—multiply by 1.1.
 - b. Rubber or neoprene, $\frac{1}{8}$ in. thick, multiply by 1.8 for small fans to 2.7 for large ones.
 - c. Nine coat Tygon lining (i.e. heavy duty)—multiply by 1.2.
 - d. Brass construction—multiply by 1.5 for small fans to 2.5 for large fans.

RADIAL FLOW PRESSURE BLOWERS

Centrifugal pressure blowers of this type are designed for delivery pressures from 6 to 42 in. of water. Riveted steel plate construction is used to produce a range of sizes from 2 to 6 ft. diameter by 0.5 to 1.5 ft. thick.

In plotting the graph for these units the capacity figures were selected for 12 in. S.P. Using these figures as a base any of the blower sizes can be safely operated at 12 in. S.P. over capacity ranges from 50 to 150 percent of these values.

The plotted costs are March 1952 figures on the bare blower for delivery pressures from 6 to 20 in. These costs cover wheel, casing and base for a direct connected motor.

In order to estimate drive cost the motor horsepower and speed must be known. Since changes in fan operating conditions will affect these two values it is necessary to indicate the relationships which will exist under

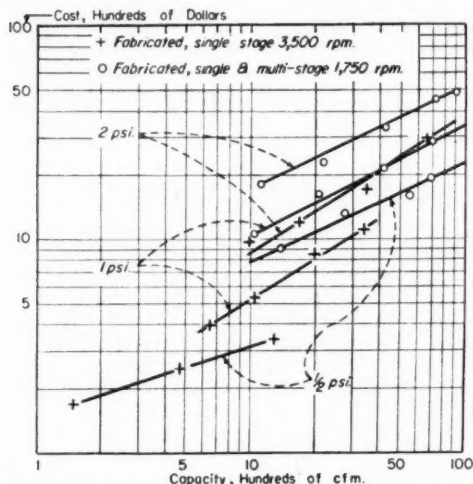
various conditions. It should be remembered that pulley size ratio must be considered where belt drives are used.

For average conditions simply read bhp. and rpm. indicated on the bhp. curve on the graph. This will be correct for delivery pressures from 6 to 20 in. and for average flow.

When the static pressure is outside this range the bhp. varies approxi-

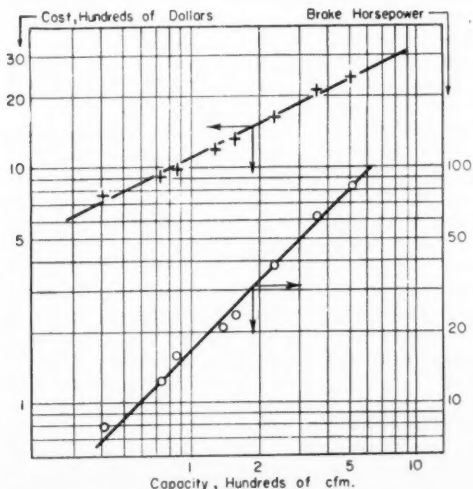
mately as the 0.9 power of the gage pressure differential. Wheel speed varies roughly as the cube root of the gage pressure.

Where the flow for a given unit is different than shown on the graph but within the specified range previously mentioned the bhp. varies as the square of the flow at small pressure differentials (4 to 6 in. of water), and more as the first power for larger



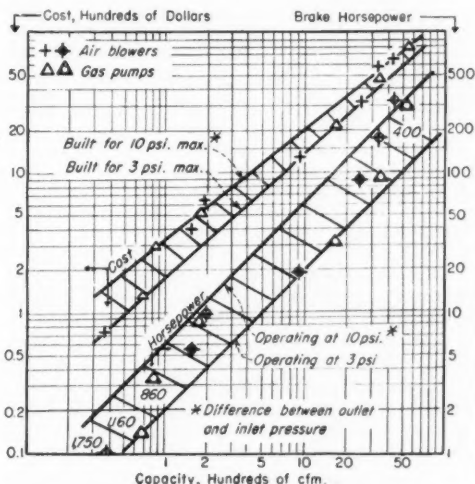
RADIAL FLOW HIGH PRESSURE BLOWERS

Costs are shown for fabricated blowers; 3,500 rpm single stage, 1,750 rpm. single and multi-stage at 3 pressures.



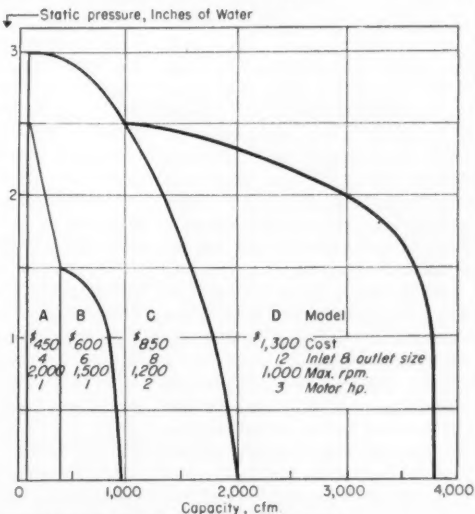
POSITIVE ROTARY COMPRESSORS

Graph shows data for 40 psi. delivery pressures. Only two speeds are used with this equipment.



POSITIVE ROTARY BLOWERS AND PUMPS

Curve bands give data for operating pressures from 3 to 10 psi. Numbers on bhp. curve show blower speed.



CERAMIC CENTRIFUGAL EXHAUSTERS

Costs include base and coupling without motor. Add 12 percent for direct drive base; 16 percent for porcelain.

differentials. Wheel rpm. goes up as the fourth root of the flow.

Price Modifications—Base prices are multiplied by the noted factors where equipment modifications are involved.

1. Higher delivery pressures.

Pressure, In. of Water	Factor
6-21	1.0
22-28	1.4
29-35	1.7
36-42	2.0

2. Other mechanical arrangements.

a. For pulley drive with extended shaft and two bearings, pulley not included—multiply by 1.5.

b. For unit with base arranged for motor and texrope drive, both not included—multiply by 1.5.

RADIAL FLOW HIGH PRESSURE BLOWERS

Air delivery at pressures from 0.5 to 7 psi. is provided by this line of centrifugal pressure blowers. Choice of units can be made from several combinations of design variations and types of construction. Among these are multi-stage blowers with cast iron housings measuring 1 to 4 ft. in diameter by 0.5 to 3 ft. long; single or multi-stage fabricated units having dimensions of 2 to 6 ft. in diameter by 1 to 5 ft. long. Over-all length is doubled when motor dimensions are included.

Two graphs are required to show data for these blowers. One graph gives March 1952 costs for 3,500 rpm. multi-stage blowers with either cast iron or fabricated housings. Similar costs on the other graph relate to 3,500 rpm. single stage fabricated blowers and 1,750 rpm. single and multi-stage fabricated units. Prices include bare blower with extended motor base and coupling, without motor.

As an aid to motor pricing the horsepower may be estimated by the expression $hp. = (cfm.) (pressure \text{ increase, psi.}) / 100$.

Price Modifications—There are only minor price differences between cast iron and fabricated construction. For accessories the following cost increases are necessary:

1. Blast gate at outlet—add 5 percent.

2. Filter silencers.

a. cast iron blowers—increase runs

from 10 percent on small machines to 5 percent on large ones.

b. fabricated steel blowers—increases range from 10 percent on small units to 15 percent on large ones.

POSITIVE ROTARY BLOWERS AND PUMPS

The twin figure-eight impellers in this equipment give positive air or gas displacement and operate at discharge pressures from 3 to 10 psi. Impeller gearing produces counter-rotation with close clearances between the impeller surfaces. Sleeve bearings are used which are replaceable on the larger blowers. Gas pumps are furnished with deep stuffing boxes to prevent gas leakage.

Blowers in this category run in size from one ft. on any dimension to 10 x 5 x 5 ft. Several hundred horsepower are required to drive the larger machines.

Net costs for March 1952 plotted on the graph are for complete blowers without drive or motor. A band of prices illustrates the effect of maximum delivery pressure on price. Prices at intermediate pressures between 3 and 10 psi. may be found by interpolation.

Capacity values shown on the graph are maximum figures for each unit. Since these are positive displacement machines, smaller flows can be obtained by proportionately slower rotational speeds.

In common with the other equipment previously discussed estimation of motor and drive cost requires that motor speed and horsepower be known. It is seen that the graph shows bhp. plotted as a band against flow rate. Spotted in on the band are some blower speeds. Interpolation will be aided by remembering that hp. is proportional to pressure difference and cfm; rpm. is nearly proportional to cfm.; cfm. is nearly independent of pressure.

Price Modifications—These units do not have any price extras since no variation is made in standard design and construction.

POSITIVE ROTARY COMPRESSORS

An eccentric rotor mounted in a cylindrical housing and fitted with phenolic resin vanes sliding in radial slots characterizes this design of positive displacement compressor. These

units are constructed of cast iron and have delivery pressures up to 40 psi. The same machines are also used as vacuum pumps.

Capacity plotted on the graph is at 40 psi. delivery pressure. The capacity at 10 psi. delivery pressure is 15 percent greater than at 40 psi. The manufacturer can furnish ratings covering use of the equipment as a compressor on hot air, sub-atmospheric air and gases other than air.

Operation of these machines as vacuum pumps necessitates some modification of the ratings. When pumping at 24 in. Hg vacuum the inlet cfm. is approximately equal to the cfm. rating at 40 psi. At lower vacuums ratings increase slightly, while at 28 in. Hg vacuum the ratings are only 75 percent of the 24 in. ratings.

The graph shows March 1952 costs for compressors with lubricator, coupling and base only. Motor costs can be estimated from speed and bhp. Speeds for this equipment are generally 865 or 1,160 rpm. Values for bhp. at 40 psi. are shown on the graph and these values decrease as the square root of the delivery pressure permitting easy interpolation.

Price Modifications—A number of accessory items used with this equipment add to the over-all cost. These are listed as follows:

1. Oil separator, filter silencers, relief and check valves—add 15 percent.

2. Air receiver.

a. For compressors up to 160 cfm. capacity—add 40 percent.

b. For compressors above 160 cfm. capacity—add 50 to 75 percent.

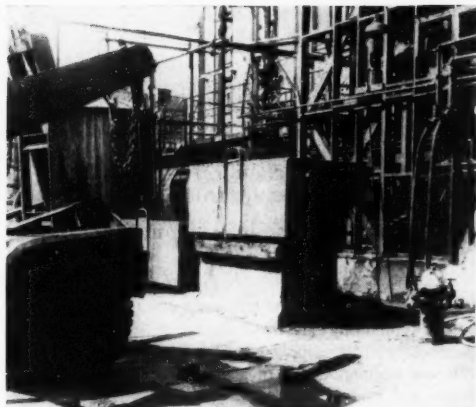
3. Texrope drive without sheaves or belts—add 25 percent.

4. Other accessories such as after-coolers, safety devices, stuffing boxes for gas etc.—add up to 25 percent more.

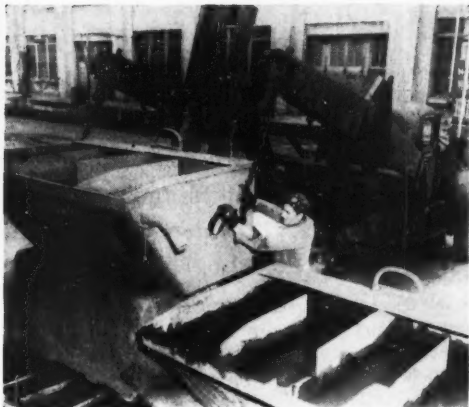
ACKNOWLEDGEMENTS

The author expresses sincere appreciation for assistance rendered by the following companies:

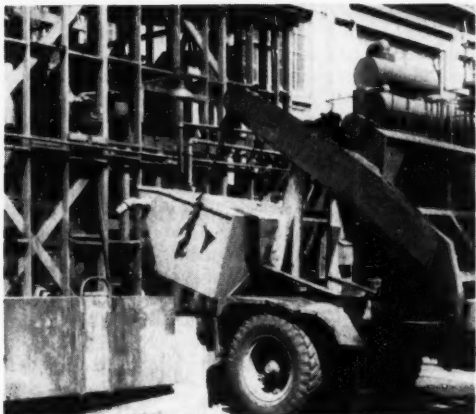
L. J. Wing Mfg. Co., Linden, N. J.; Bayley Blower Co., Milwaukee, Wis.; Lamson Corp., Syracuse 1, N. Y.; Roots-Connersville Blower Corp., Connersville, Ind.; Allis Chalmers Mfg. Co., Newark 2, N. J.; General Ceramics & Steatite Corp., Keasbey, N. J.



1. BACK-UP



2. HOOK-ON



3. LIFT



4. DUMP

Cheaper to Truck This Waste Slurry

H. J. WELLS

With the installation of a new plant waste basin some 2,000 ft. from the source of waste zinc slurry, engineers at the Bound Brook, N. J. plant of the Calco Chemical Division, American Cyanamid Co., recently had the problem of finding the cheapest way of handling the material.

A pipeline seemed the most likely choice at first. But the high initial cost of a 3-in. underground line amounting to \$10,000 would be compounded by unusually high maintenance costs of \$1,400 per yr. due to the erosive nature of the slurry.

A second alternative was to pump the waste slurry to an already available filter tub, then shovel the sludge into drums. The drums would be moved to an outside storage

area, without emptying any material into the waste basin.

Analysis showed that labor cost for filling and moving drums (\$13.20 per day) together with loss of scrap value of the drums (\$10.50 per day) offset the advantages of this method. Total cost for one year would be \$6,280.

A third method was adopted. This involves pumping to dump-truck boxes of the type shown above, allowing the water to be decanted while filling, then trucking the full boxes to the waste basin and dumping. Since the trucks were already being used in other service, no purchases of trucking equipment were necessary.

Annual labor cost of moving six truck loads per day to the waste basin is \$1,050. Maintenance of truck, boxes, and pumping equipment is extra. Cost of installation: approximately \$3,800 (\$3,000 for platform).

At a later date, the sludge will be loaded into gondola cars and shipped to customers.

H. J. WELLS is General Superintendent of Stores and Service, American Cyanamid Co., Calco Chemical Div., Bound Brook, N. J.

What Size Foundation for Your Stills and Towers?

Structural designers meet special problems in designing foundations for tall process equipment such as stills, water towers, tanks and chimneys. Here is a simplified method for determining foundation size.

ANDREW A. BROWN

The structural designer for chemical companies and petroleum refineries is frequently required to design new foundations or analyze existing ones which support tall structures such as stills, tanks, water towers and chimneys. For these tall structures the horizontal thrusts caused by wind, off-center piping, machinery or earthquake forces are of such magnitude as to cause large eccentricities.

If the soil explorations indicate pile foundations are desirable the design is relatively simple because the pile layout is usually made to eliminate the possibility of piles in tension. However, if spread footings can be used, the problem becomes more difficult if the design criteria permit the resultant forces to be outside of the kern area (see below). A number of firms require that a factor of safety of 2.0 against overturning be maintained. That is, if the summation of moments of all the forces acting on the structure is taken about the outside edge of the footing, the total of those tending toward overturning should be half as large as the total of those resisting it. Under some circumstances a lesser factor of safety is permitted. For instance, if a foundation for a high still were to be designed for earthquake forces, a maximum wind velocity and on the assumption that the still itself was empty, all three conditions would be unlikely to occur simultaneously.

The footings for the types of structure considered in this article are usually constructed octagonal or hexagonal in shape to reduce forming

costs. Since the introduction of plywood, which can be shaped to form a circle, some of the more recently constructed foundations are circular.

For simplicity of design and analysis the footings are to be assumed as circular, their size being that of the inscribed circle tangent to the sides of the hexagon or octagon. Such a circular footing has been used in developing the formulas required to compute the values plotted in Fig. 2. The final results are affected very little by using a circular base for design purposes.

The development of the equations is not given here although the method will be described briefly. It is assumed that the soil pressure under the foundation varies as a straight line when there is eccentric loading. In Fig. 1a the rectangular area under the foundation represents the soil pressure condition when there is no eccentric loading. When there is wind pressure on the still, or other cause of eccentric loading of the foundation, the soil pressure variation is as in Figs. 1b, c, or d.

In the case shown in Fig. 1b the resultant load on the base of the foundation has an eccentricity of less than $D/8$ and is inside what is called the kern area. The kern area of any plain

figure is the area around the center of gravity of the figure within which any applied load will produce stresses of only one sign throughout the figure. In a circle of diameter D , the kern is a concentric circle of radius $D/8$. Since the resultant is applied in Fig. 1b at a radius of less than $D/8$, there is positive soil pressure over the entire area of the foundation.

In Fig. 1c the resultant has an eccentricity of exactly $D/8$, which means that it falls on the boundary of the kern area. Here the soil pressure varies linearly from a maximum at the leeward edge of the foundation, to zero at the windward side. In Fig. 1d the eccentricity of the resultant is greater than $D/8$, so there is a change of sign of the soil pressure on the side opposite the resultant and the unshaded part of the foundation tends to lift.

We are interested in two main cases, the first where the resultant outside the kern area gives situations like Fig. 1d; and the second, where the resultant is within the kern and gives situations like Fig. 1b.

Case I, Resultant Outside Kern—In this case it is necessary to use calculus. We first compute the volume of the soil pressure solid shown in Fig. 1d, taking the maximum soil pressure f as the permissible pressure,

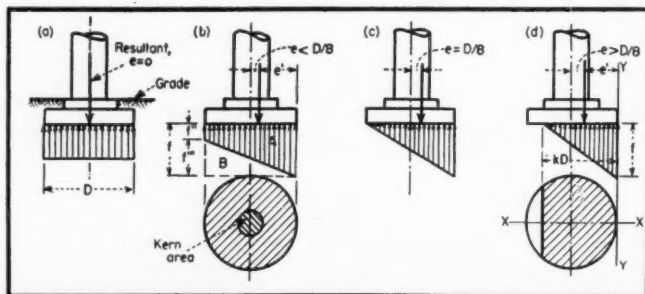


Fig. 1—As foundation loading becomes more eccentric, the soil pressure pattern shifts as these diagrams show.

A. A. BROWN, formerly a senior design engineer with one of the large chemical companies, is now a Commander in the USNR. As design and construction officer, he is attached to the Public Works Office, Fifth Naval District, Norfolk, Va.

and integrating to obtain an expression of the form of $V = fD^3C_e$, where C_e is a function of k , the fraction of the foundation width under soil pressure. To obtain the eccentricity e , which is the distance of the center of gravity of the soil pressure solid from the center line, we first take moments of the volume of soil pressure solid about the leeward edge of the foundation and integrate to obtain an expression of the form of $M_e = fD^3C_m$, where C_m is another function of k . Dividing M_e by V then gives the moment arm of the entire soil solid, that is, the distance of the center of gravity from the Y axis. This distance is $e' = (fD^3C_m)/(fD^3D_e)$, but since $e' = D/2 - e$, then $e/D = \frac{1}{2} - (C_m/C_e)$. This is the equation we desire.

Table I lists values of k from 0.1 to 1.0 and the corresponding calculated values of C_e and C_m , from which e/D is computed. Note that at $k = 1.0$ the condition of Fig. 1c is obtained and $e = D/8$. In Fig. 2 e/D is plotted against the expression $\Sigma W/ef$, in which the factors are known in any particular problem. This expression is obtainable from e/D and C_e by recalling that ΣW , the total weight, is equal to volume V and also to fD^3C_e . Therefore, $C_e = \Sigma W/fD^3$ or $\Sigma W/ef = fD^3C_e/ef$, and $\Sigma W/ef = C_e/(e/D)^2$.

Case II, Resultant Inside Kern—This case is easily solved without calculus. The soil solid of Fig. 1b is calculated in terms of D , f' and f'' . For any particular value of e/D we then take the moment of the soil solid volume A about the center line and equate it to the moment of volume B about the center line. From this the relation of f' and f'' is found. Since $C_e = (\pi D^3/4)(f' + f''/2)$ and $f = f' + f''$, C_e can then be expressed in terms of fD^3 . Table II tabulates values of e/D smaller than $\frac{1}{2}$ (at which the resultant falls on the kern boundary) and from this f' , f'' and C_e are calculated. Values of $\Sigma W/ef$ are calculated from C_e as in Case I and the plot of Fig. 2 is continued for values of e/D less than $\frac{1}{2}$ (resultant within the kern area).

We are now ready to use Fig. 2 for design. The designing engineer usually has the weight of vessel or chimney, the allowable soil bearing pressure, the eccentric loads, wind moments, earthquake forces, etc. From these he esti-

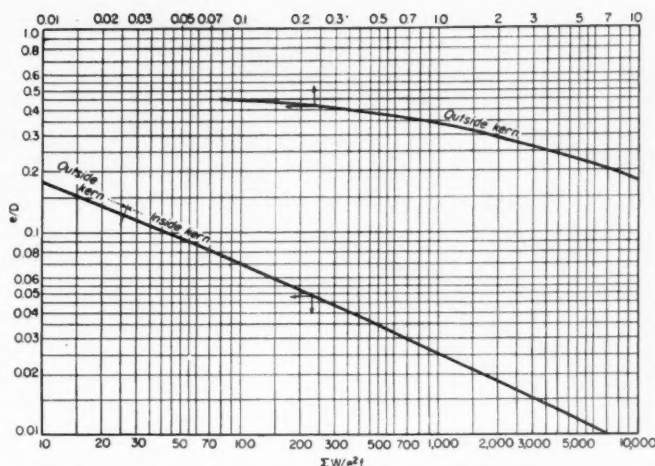


Fig. 2—Knowing factors of foundation loading this chart determines foundation diameter or maximum soil pressure.

Table I—Values for Fig. 2 With Resultant Outside Kern

k	C_e	C_m	C_m/C_e	$e/D = \frac{1}{2} - (C_m/C_e)$	$C_e/(e/D)^2 = \Sigma W/ef$
0.10	0.01656	0.00074	0.0448	0.4552	0.079
0.20	0.04557	0.00384	0.0843	0.4157	0.264
0.25	0.06295	0.00662	0.1050	0.395	0.403
0.30	0.08175	0.01029	0.1259	0.374	0.583
0.40	0.1223	0.02036	0.1665	0.333	1.099
0.50	0.1666	0.03424	0.2055	0.294	1.921
0.60	0.2126	0.05180	0.2436	0.256	3.235
0.65	0.2360	0.06181	0.2620	0.238	4.17
0.70	0.2595	0.07270	0.2802	0.220	5.37
0.75	0.2830	0.08344	0.2990	0.202	6.97
0.80	0.3066	0.09653	0.3149	0.185	8.94
0.85	0.3280	0.1087	0.3270	0.173	10.93
0.90	0.3509	0.1217	0.3470	0.153	14.99
0.95	0.3720	0.1362	0.362	0.138	19.60
1.00	0.3927 (Resultant on edge of kern)	0.1500	0.375	0.125	25.13

mates the weight of foundation required, and from Fig. 2, the diameter of inscribed circle.

A large still weighs 300,000 lb. and the estimated weight of its foundation plus any earth fill is 160,000 lb. The wind moment is 1,000,000 ft.-lb. and the allowable soil loading, 3,500 lb./sq. ft. Then $e = M/\Sigma W = 1,000,000/460,000 = 2.17$ ft. and $\Sigma W/ef = 460,000/(2.17)^2 \times 3,500 = 27.9$. From Fig. 2 $e/D = 0.12$ and $D = 2.17/0.12 = 18.1$ ft. Use 18 ft.

If an overturning moment of 592,000 ft.-lb. is applied to a still which, with its foundation and earth fill, weighs 148,000 lb., what will the soil bearing pressure be if the foundation is an octagon 16 ft. across? Here $e = 592,000/148,000 = 4.0$ ft. Therefore $e/D = 4/16 = 0.25$. From Fig. 2 at $e/D = 0.25$ we find $\Sigma W/ef = 3.7$. Then $f = 148,000/(16 \times 3.7) = 2,500$ lb./sq. ft.

Fig. 2 gives interesting information

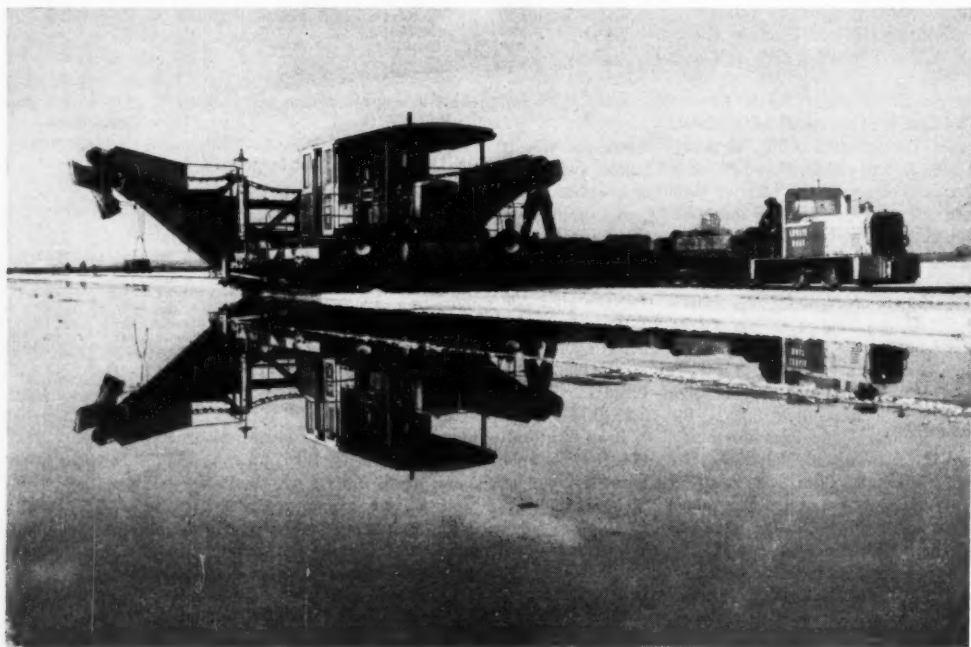
Table II—Values for Fig. 2 With Resultant Inside Kern

e/D	C_e	$\frac{1}{2} - (C_m/C_e)$	$C_e/(e/D)^2 = \Sigma W/ef$
0.4006	0.120	0.120	27.82
0.4177	0.110	0.110	34.52
0.4363	0.100	0.100	43.63
0.4564	0.090	0.090	56.34
0.4789	0.080	0.080	74.84
0.5034	0.070	0.070	102.7
0.5306	0.060	0.060	147.3
0.5610	0.050	0.050	224.4
0.5950	0.040	0.040	371.8
0.6136	0.035	0.035	500.8
0.6373	0.030	0.030	703.7
0.6545	0.025	0.025	1,047.0
0.6770	0.020	0.020	1,693.0
0.7012	0.015	0.015	3,116.0
0.7062	0.014	0.014	3,693.0
0.7153	0.013	0.013	4,232.0
0.7166	0.012	0.012	4,976.0
0.7218	0.011	0.011	5,966.0
0.7269	0.010	0.010	7,269.0

that will help in limiting or maintaining the factor of safety. For instance, for a factor of safety of 2, the value of $\Sigma W/ef$ should be 3.7 or greater. For 1.5 it should be 1.1 or greater. For all values of $\Sigma W/ef$ greater than 25.13 the resultant falls within the kern—but outside for smaller values.



That speck on top of the pile . . .



Mammoth machine, developed by Leslie engineers, can harvest six acres of salt a day. It loads directly into miniature railroad cars which haul the salt to a washing plant. Washed salt goes to the 500,000-ton stockpile shown above.



... is a bulldozer

Passing the Salt at the rate of 6,000 tons per day is a machine-sized job. Here's how they do it.

ELLIOT SCHRIER

It's no mean job to "cultivate" close to 29,000 acres of brine ponds and to "harvest" up to 900,000 tons of salt every year.

But that's what Leslie Salt Co. is doing along the southern shores of San Francisco Bay.

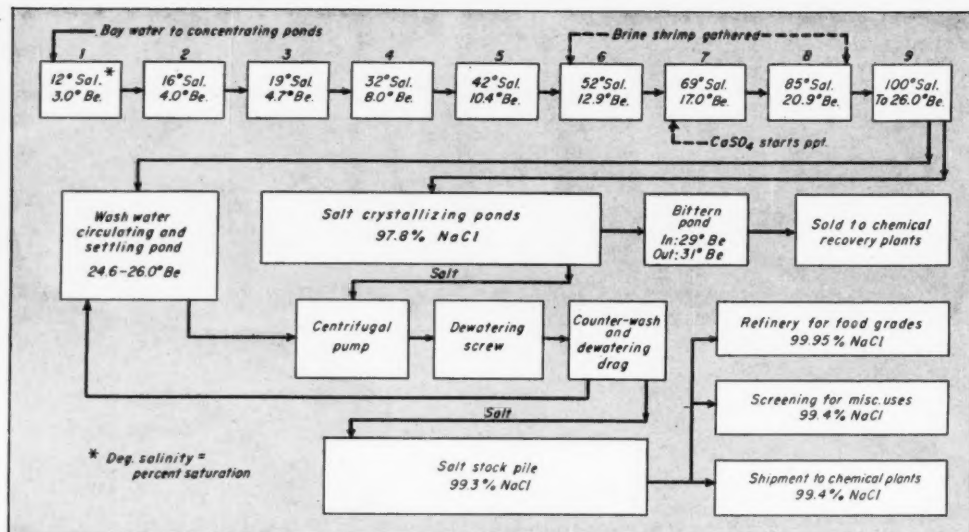
And they've done such a good job that Leslie now has the largest and most highly mechanized solar evaporation "salt farm" in the world.

By using the sun, wind, special harvesting machines and their own engineering skill, they've made this one of the few places anywhere that can turn out high-purity salt by solar evaporation on a sound chemical engi-

ELLIOT SCHRIER, our Western Editor in San Francisco, turned in this first-hand account of how Leslie Salt "cultivates" its ponds and "harvests" its salt.



Immense solar evaporation ponds of Leslie Salt Co. line San Francisco Bay's shore near Newark, Calif. Leslie now has 29,000 acres under salt cultivation.



BRINE flow through Leslie's "salt farm" is shown here. It's necessary to process 8,800 gal. of water to get a ton of salt.

neering basis. Their method is now known as the California process.

What's more, Leslie engineers are going ahead with their plans to operate on a bigger scale. By 1958 they expect to have over 40,000 acres and a fifth plant in operation on San Francisco Bay. When the fifth plant reaches full production in 1965, Leslie's solar salt "crop" will hit close to 1,300,000 tons annually.

► **The Good Earth**—Several factors (other than a ready market) combine to make San Francisco Bay the ideal place for a solar salt industry:

- Lack of rain and the prevailing westerly winds cause a high net rate of evaporation from the end of March through September;
- Thousands of acres of low-lying marsh land allow evaporating ponds to be laid out and operated at a low unit cost;
- Marshes at or near sea level keep pumping costs at a minimum;
- The peculiar type of clay forms a water-tight pond bottom that cuts down the leakage of brine.

► **Engineered Ponds**—Building a pond system is a big engineering job. Nine or ten concentrating ponds and several crystallizing ponds make up a production unit.

Concentrating ponds should cover an area 15 times as great as the crystallizing ponds. They are built by using floating clamshell dredgers to raise

levees to a height of about 4 ft. on ground low enough that water can be taken in through floodgates at high tide without pumping. Wherever possible these floodgates take advantage of the driving force of the prevailing winds.

Concentrating ponds, the largest covering up to 1,100 acres, are irregular in size and shape, more or less follow the contour of the land. But crystallizing ponds must be regular in size and shape, with flat, well-rolled bottoms sloping gently to allow the bittern to drain.

It takes 5-7 years to make a pond system impervious and to bring it to maturity; then it can produce up to 40 tons of salt per acre per year.

From a chemist's standpoint the operation consists of fractional crystallization; from an engineer's standpoint it's materials handling.

► **Like a Farm**—The production cycle is analogous to a large-scale agricultural operation. No. 1 concentrating pond is initially flooded ("planted") during the fall, after summer evaporation has raised the total salts content of the Bay water to about 3.5 percent.

As the density of the water increases due to evaporation, it is moved slowly forward through the concentrating ponds. Gravity and the natural tidal flow are used as much as possible.

Algae and other microscopic vege-

tation cause the ponds to change color gradually from blue-green through green and yellow to a deep rust; experienced "salt farmers" can estimate the salinity of each pond with a high degree of accuracy simply by noting its color.

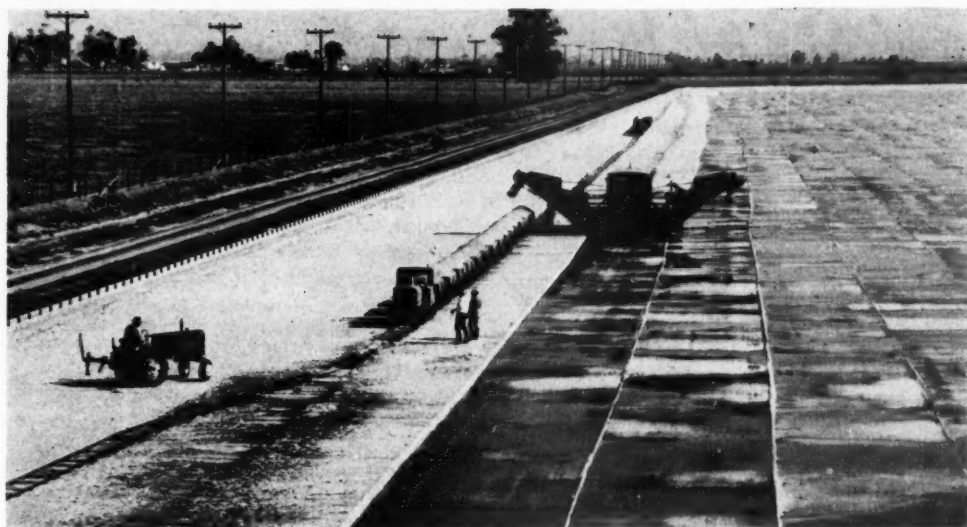
Brine goes to the crystallizing ponds when it reaches a density of 24.6-26 deg. Be. It's held there until it reaches 29 deg. Between these limits the maximum amount of high-purity sodium chloride deposits.

Most of the gypsum has settled out by the time the brine reaches 25 deg. Be.; magnesium salts do not precipitate in quantity before about 30 Be. Carbonates of calcium, magnesium and iron also drop out at about the same time as the calcium sulphate.

There's still about 12 percent sodium chloride in brine of 30 Be. But the volume is small and further evaporation would cause contamination with bittern. Leslie sells over a million tons of bittern each year to nearby chemical plants for its magnesium and bromine content.

► **Seasonal Floods**—Toward the end of December, right after the harvesting season, the crystallizing ponds are flooded with weak brine to pick up any residual salt. This is then drained to intermediate concentrating ponds.

As soon as the rainy season is over (around the middle of March) the ponds are brought almost to dryness.



SALT harvesting is done by machines that can handle 6,000 tons a day. Coast demand for salt has doubled since 1942.

They are then rolled with mechanical rollers and prepared for the coming crop.

Using two 5,000 gpm. 40-hp. pumps, the entire crystallizing area is flooded to a depth of 14 in. with saturated brine from the pickle pond (final concentrating pond). The level is kept constant until the density reaches 29 deg. Be.; then the brine goes to the bittern pond and the crystallizing pond is refilled from the pickle pond. This cycle is repeated until the end of September, when the harvest begins.

By this method of controlled crystallization, about 75 percent of the sodium chloride in the water passing through the system deposits in large crystals 4-6 in. deep and almost 98 percent pure.

► **No Pick-and-Shovel**—Leslie's harvesting method shows how thoroughly it has studied the materials handling phase of its process.

In the late 30's Leslie engineers developed a \$40,000 tractor-type machine that can harvest 6 acres per day.

Revolving picks break up the salt and deliver it to a drag conveyor which loads bottom-dump cars with two tons of salt per car. Two of these machines, each with a nine-man crew per shift, have cut the harvesting season to three months; under the old pick-and-shovel method it often lasted for six months.

Since the object is to delay harvesting yet finish it before the rainy season really gets under way, this speed-up in harvesting has increased Leslie's yearly yield considerably.

The plant operates 24 hours a day during the harvesting season. A 24-in. gage railroad hauls the salt in 12-14 car trains from the harvesting machines to the washing plant; there it's washed with saturated brine to remove dirt picked up from the pond bottom. Fine particles of calcium sulphate are removed along with mother liquor.

The heavy salt slurry, elevated in two streams by centrifugal pumps, goes to twin 2 x 20-ft. screw classifiers which act as dewatering screws. Each stream is then passed through 24 x 20-in. steel log washers.

A high-pressure brine spray followed by a fine spray of fresh water completes the washing operation as the salt is elevated over the perforated bottom of a 10x100-ft. inclined dewatering drag to the stock piling conveyors.

► **Bulldozers, Too**—When operating at full capacity the main Leslie washing plant can dump 250 tons of salt per hour onto the stock piles, where it drains. The pile soon develops a hard crust, and rain losses are only 5-10 percent.

Removing the salt from the stock-piles is an earth-moving problem.

Caterpillar diesel D-6 bulldozers feed a continuous conveyor that can carry salt to the refinery, the rewash building or to bulk shipping points.

With close to a million tons of solids and 40,000 acre-ft. of water to move each year, Leslie has had to adopt machine methods to keep up with the Coast's demand for salt.

Leslie engineers have found it practical to use ordinary iron and a rigorous maintenance and inspection program to beat corrosion on its "salt farms." They are gradually replacing the creosote-treated wooden floodgates with automatic cast iron ones. While wooden gates are more resistant to corrosion, they are not as watertight as iron ones, nor can they be operated automatically. Wood is used for some pump sumps and flumes.

► **Going to Market**—Leslie, major salt producer west of the Rockies, has no trouble finding markets.

West Coast demand for salt—less than 500,000 tons in 1942—is now close to 1,000,000 tons yearly; it'll probably top 1,200,000 tons by 1955. Already, exports and coastal shipments have placed salt second only to petroleum products in tonnage passing through San Francisco's Golden Gate.

Right now, some 54 percent of the West Coast's salt output goes to the chemical process industries, almost 35 percent to chlor-alkali plants alone. And these figures are growing.

Editorial Viewpoints

Our Last Industrial Frontier

Our Intermountain West—that sprawling area west of the Rockies and east of the Sierras—may well be the nation's last industrial frontier.

Today it shows more promise than ever—but no boom. And most industrialists who have studied the area agree that the boom, though inevitable, will be slow to come.

Behind this long-range optimism is the fact, itself slow to gain recognition, that the Intermountain Empire is a vast reservoir of natural resources for American industry.

This is particularly true for the chemical process industries. Name any basic raw material—phosphate rock, salt, sulphur ores, limestone, natural gas, potash, coal, soda, gypsum—and the chances are you'll find plenty of it in Utah or Idaho or Colorado or some other of the Intermountain states. But with the exception of phosphate rock, none of these basic materials has yet been exploited on a really large scale. And the West's phosphate boom, now in full swing, did not get under way until after the last war.

The one thing that the Intermountain area needs is markets, local and national, big enough to support profitable industrial enterprises. As one industry leader put it recently: "This area is still—in the language of feudalism—a fief. We look to New York for financing, to San Francisco for field supervision—and to God for a market."

We are confident that markets will develop, slowly but surely. And as our Western Editor, Elliot Schrier, points out in his Intermountain survey in this issue (p. 356), a more favorable freight-rate structure could become the area's most powerful catalyst.

For the chemical process industries, the Intermountain West is the country's largest untapped reservoir of basic raw materials. Far-sighted chemical leaders, now recognizing this, are beginning to plan accordingly.

No Bottleneck Here

Seldom if ever publicized but one of the most important groups within the U. S. Atomic Energy Commission is its Committee of Senior Reviewers. This is the agency established about six years ago to advise the Commission on the classification and declassification of scientific and technical information. Only recently, however, have engineers in industry awakened to the fact that technology has never had adequate representation on this strategic committee.

We can thank AEC general manager Marion W. Boyer, among others, for a needed reorganization of the

committee and its expansion to include some able engineers and technologists. Dr. Thomas B. Drew, head of chemical engineering at Columbia, Dr. R. H. Crist, director of physical research for Carbide and Carbon Chemicals and Dr. John P. Howe, head of the metals division of the Knowles laboratory of General Electric are all well-known for their present or past experience in industry.

The more scientific phases of the committee's work will continue to have the expert attention of Dr. Warren C. Johnson, associate dean of physical sciences at Chicago, Dr. J. M. B. Kellogg of Los Alamos Scientific Laboratory and Dr. R. Richardson, associate professor of physics at UCLA.

It is a well-known fact that in the past most of the papers declassified by AEC have had to do with science rather than technology. Not all of the responsibility for this rests with the senior reviewers who must operate in strict compliance with the security provisions of the basic law. But, in our opinion, this reorganization marks another forward step toward more effective participation in the AEC program on the part of industry and its engineers.

Toward Greater Safety

Long plagued by a high accident rate, the fertilizer industry is now determinedly moving to do something about it. The industry will soon have its own section of the National Safety Council instead of being only a part of the Council's chemical section. And that's only the beginning.

This intensified effort is motivated by deepening concern over the high injury rate in the manufacture of fertilizers. According to the National Safety Council, the fertilizer industry has 14.92 disabling injuries per million man-hours—far above the chemical industry's 5.48 injuries. Severity is likewise greater, 1.93 days being lost per 1,000 man-hours, compared with only 0.85 for chemicals. The many small plants with employees not always among the most skilled and alert may be contributing factors, but the hazards are real.

Convinced that these hazards peculiar to fertilizer manufacture can be dealt with, industry safety men have not only decided to set up their own separate section of the Council, but have called upon experts to demonstrate at the 40th National Safety Congress in Chicago this month how these hazards can be minimized.

Most dramatic will be the demonstration by Mark Withey of the Trojan Powder Co. of multiple-shot blasting of stored fertilizer. Withey will show by actual blasting at the Chicago Heights plant of International Minerals & Chemical Corp. that multiple shots with

delayed action caps are safer than the older single-shot practice.

Other aspects of safety in fertilizer plants will likewise be stressed. An industrial psychologist will explain the human element in preventing accidents. Fire prevention in design of plants and in maintenance, housekeeping in fertilizer plants, dust control, and the conduct of safety meetings will all be tackled. Credit fertilizer safety men with an encouraging effort to do something about an admittedly serious problem, and watch for that tragic accident rate to come down.

For Tomorrow's Automatic Plant

Every chemical engineer who visited the 7th Instrument Show and ISA Conference at Cleveland last month must have come away with the conviction that tomorrow's automatic plants can't be far away. Instruments will make it possible—and instruments are the fastest developing branch of the industrial equipment tree. It is only seven years since the Instrument Society of America was organized. The roots of ASME's Industrial Instruments and Regulators Division go back only 16 years. And yet, 1952 mustered close to 200 exhibitors at Cleveland, which is still only one-seventh of the industry.

Two trends shown at Cleveland were outstanding in their bearing on the automatic plant. Most of us are beginning to become familiar with the first—the rise of automatic analysis instrumentation. The second is by no means so clear, but it points toward new means for automatic data recording, and indirectly toward a tool which may underlie automatic-plant development. One of the biggest deterrents today toward full automation is lack of complete process information. Perhaps the best method of getting such information is to analyze vast quantities of data accumulated from existing plants. Here is where the new "analog-to-digital" recording systems come in.

Briefly, they sample continuous measurements at intervals as short as necessary, then record the data as printed numbers or punched cards. Ideally, for process investigation, punch-card recording can lead to automatic computer analysis of the data, and hence to development of "process equations" on which to base our future robot plants.

Why Hire the Handicapped?

This month for the eighth time the nation is observing National Employ the Physically Handicapped Week. Our government is throwing the spot light on something most employers in our industry know already: "It's Good Business to Hire the Handicapped."

That's not just a slogan either. The U. S. Department of Labor recently made a joint survey with the Veterans' Administration. Researchers at the two agencies matched the actual work records of 11,000

disabled workers against those of 18,000 nondisabled workers performing identical tasks in more than 100 plants.

Here's what they found:

- Impaired workers as a group produce at slightly higher rates than unimpaired workers on the same jobs.
- Impaired workers sustain fewer disabling injuries than nonimpaired workers exposed to the same work hazards.
- The handicapped have the same wide range of skills, abilities, and interests as the nonhandicapped.
- Quit rate and absenteeism are about the same in both groups.

Vice Admiral Ross T. McIntire, Chairman of the President's Committee on Employment of the Physically Handicapped expresses the nation's sentiments very well in these words to the volunteers who carry on the noble work of restoring the handicapped worker to his rightful status as wage earner and taxpayer:

"Our government has estimated that 2 million handicapped Americans can be added to the labor force through rehabilitation processes. We must find these people, rehabilitate them, hire them. We must find jobs for the disabled veterans returning from Korea.

"And we must aid the civilian handicapped to match their abilities to the requirements of jobs best suited to their individual talents. Certainly, this is challenge enough for all the volunteers in this important and dedicated work. . . . The handicapped are ready. The nation is willing. We should be able to do this job better than ever before.

"This is our mission. God speed you all to its accomplishment."

Chemical Production Data, 1953

Plans are now being made by the Bureau of the Census to gather data on production of chemicals next year. Cooperation of chemical companies has been asked so that the lists of chemicals may be as complete as is feasible, and fully accurate. Fortunately the Bureau knows that the exact form of the questionnaire is important if the returns from industry are to be free from ambiguity.

Those who have some special needs for commodity data should promptly take up their particular problems with the chemical division of the Bureau. There is still time for the addition of a few questions on the forms to be used. And those who have had difficulty with earlier questionnaires or Census reports should also give their suggestions.

It is unfortunate that the number of commodities on which data can be gathered will be quite limited. This makes it even more important that the figures asked for be those most urgently needed and that there be no difficulty in preparing replies that might delay the early completion of the surveys. Now is the time to offer the cooperation so essential to get those results.

Shortcut to Heat Exchanger Design—I

You can cut in half the time required for designing heat exchangers by the conventional methods. Here's how to do it for conditions of no phase change and cross-flow in shell.

C. H. GILMOUR

NOTE—The method of designing heat exchangers described here is applicable to other types of heat exchangers such as condensers and reboilers. This is the first in a series which will show the application of the method to other types of exchangers.—EDITOR.

$$\frac{\Delta T_1}{\Delta T_M} + \frac{\Delta T_0}{\Delta T_M} + \frac{\Delta T_w}{\Delta T_M} + \frac{\Delta T_s}{\Delta T_M} = 1 \quad (I)$$

$$\frac{\Delta T_1}{\Delta T_M} = 262 \left(z_1^{1/3} W_1^{2/3} / s_1^{8/9} \right) \left[W_1^{0.2} (t_H - t_L) / \Delta T_M \right] \left(d_1^{0.8} / n^{0.2} L \right) \quad (II)$$

$$\frac{\Delta T_0}{\Delta T_M} = 027 \left(z_0^{0.8/3} W_0^{2/3} / s_0^{8/9} \right) \left[W_0^{0.4} (T_H - T_L) / \Delta T_M \right] \left(N_{PT}^{0.282} P^{0.6} / n^{0.718} L \right) \quad (III)$$

$$\frac{\Delta T_w}{\Delta T_M} = 159 \left(c_i / k_w \right) \left[W_i (t_H - t_L) / \Delta T_M \right] \left(d_0 - d_i \right) / n d_0 L \quad (IV)$$

$$\frac{\Delta T_s}{\Delta T_M} = 3820 \left(c_i / h_s \right) \left[W_i (t_H - t_L) / \Delta T_M \right] \left(1 / n d_0 L \right) \quad (V)$$

Principal reason for designing any heat exchanger is to determine certain factors so that the fabricator can supply you with the exchanger that will best do the job at hand.

Whereas conventional methods of design call for tedious calculation of factors not needed by the fabricator, the method described here eliminates the unnecessary calculations. As a result time required for design is cut in half.

To be more specific, conventional methods call for calculation of tube and shell fluid velocities, heat load, and coefficients of heat transfer for the individual films—from which the tube number, diameter and length are determined.

The shorter method yields the desired results directly by a systematic procedure which places all calculations on a single sheet of paper. Shell side design is greatly simplified.

Although used primarily for design purposes, the computation sheet for this method also works in reverse. It

C. H. GILMOUR is staff engineer with Carbide and Carbon Chemicals Co. at S. Charleston, W. Va. Previously he was assistant director of the Boston station, School of Chemical Engineering Practice, Massachusetts Institute of Technology (1929-1931). At Carbide, Mr. Gilmour designs heat exchangers for the South Charleston, Institute, Texas City and Whiting plants. He has designed more than 500 of the type referred to in this article.

	Physical property factors for pressure drop	Work factors for pressure drop	Mechanical design factors for pressure drop	
$\Delta P_i =$	$\left(z_1^{0.2} / s_1 \right)$	$\left(W_i / n \right)^{1.8}$	$\left[\frac{N_{PT} (L_0 / d_i + 16 \text{ or } 25)}{(5.4 d_i)^{3.8}} \right]$	(VI)
$\Delta P_o =$	$\left(0.326 / s_o \right)$		$L_o / P \cdot D_o$	(VII)

may be used to find unknown quantities from observed data on heat exchangers which are actually performing, or to predict the performance of an exchanger under conditions other than those for which it was designed.

DEVELOPMENT OF METHOD

Heat balance for each of the four resistances to heat transfer are:

For tube side film:
 $u_1 c_1 (t_H - t_L) = h_i A \Delta T_1$
 For shell side film:
 $u_o c_o (T_H - T_L) = h_o A \Delta T_o$
 For tube wall:
 $u_1 c_1 (t_H - t_L) = h_w A \Delta T_w$
 For scaling:
 $u_1 c_1 (t_H - t_L) = h_s A \Delta T_s$

Then the coefficients for the fluid films obtained from the Colburn correlation are inserted in the first two equations. The Colburn correlation:

$$(h / cG) (c \mu / k)^{1/3} = f / 2$$

Two physical properties which are often hard to find recorded in the literature are eliminated by use of the Weber equation.¹ These properties

are thermal conductivity and specific heat. Values from the Weber equation are inserted for k in the Colburn correlation. The Weber equation:

$$k = 0.86 \text{ cm}^2 / \text{M}^{1/2}$$

In each of the four heat balance equations, the area is inserted in terms of the number, diameter, and length of tubes:

$$A = n \pi (d_o / 12) L$$

Each heat balance equation is then solved for ΔT , the temperature drop across the resistance. The sum of these temperature differences equals the total temperature difference:

$$\Delta T_1 + \Delta T_o + \Delta T_w + \Delta T_s = \Delta T_M$$

Dividing both sides by ΔT_M we get Eq. I.

Each of the ratios in Eq. I after making the substitutions indicated boils down to a product of four significant factors—a numerical factor \times a physical property factor \times a work factor \times a mechanical design factor according to Eqs. II-V. Known physical property and work factors are in-

serted leaving the mechanical design factors as the unknowns.

In the computation, the sum of the values obtained are made to approximate unity to satisfy Eq. I. This yields the information necessary to specify a heat exchanger that will do the job as far as heat exchange alone is concerned. However, we may be using twice the heat exchange area actually required.

This is where pressure drop enters the picture. The Colburn correlation tells us that we can expect greater heat transfer with larger pressure drops. This of course applies to both the tube and the shell.

By a rationalization process similar to the foregoing we can obtain the pressure drops as a product of three of the same significant factors according to Eqs. VI and VII. Here we have used the Colburn "j" factor concept.²

MAKING THE COMPUTATION

Essentially, use of the computation chart involves solving Eqs. I through VII, with the aid of the alignment charts that follow.[†] The "sum of products" on the computation chart refers to the sum of the ratios in Eq. I. This sum must be equal to or less than 1.

Corrected mean temperature difference for use in these calculations is determined in the space indicated on the chart with the aid of correction factor charts.⁹ The log mean temperature difference which represents the driving force in heat transfer is multiplied by a correction factor less than 1. This factor varies depending on the number of shell and tube passes. For instance, in the situation illustrating the example which follows, 0.815 is the correction factor for an exchanger consisting of one shell pass and two or more tube passes. Although correction factors of 0.955 and 0.985 may be applied for exchangers of two shell passes with four or more tube passes and exchangers of three shell passes with six or more tube passes respectively, the 0.815 factor is chosen. Reason: the 0.955 and 0.985 factors, although they represent less of a cut in driving force, also represent ex-

[†] The physical property factor for gases may be obtained from the alignment chart used to find the physical property factor for pressure drop by factoring. If $z = 0.02$ and $s = 0.085/62.3$ or 0.00136 for the gas, then:

Factors for $z = 0.02 = 0.2 \times 0.1 \times 1.0$
Factors for $s = 0.00136 = 0.136 \times 0.1 \times 0.1$
Product of f_p values for $z = 0.2$ and $s = 0.136$, $z = 0.1$ and $s = 0.1$, $z = 1.0$ and $s = 0.1$ equals value of f_p where $z = 0.02$ and $s = 0.00136$.

NOMENCLATURE

Symbols	Designations	Units
A	Surface area	Sq. ft.
c	Specific heat	Btu./lb./°F.
d	Diameter of tube	In.
d _s	Diameter of shell	In.
F	Heat transfer factor (defined by subscript)	None
f (on chart)	Pressure drop factor (defined by subscript)	None
f (in text)	Fanning friction factor	None
G	Mass velocity of fluid	Lb./hr./sq. ft.
h	Film coefficient of heat transfer (based on external surface area)	Btu./hr./sq. ft./°F.
k	Thermal conductivity	Btu./hr./ft./°F.
K	Abcissa of ΔT correction factor charts	None
L	Total series length of path on tube side	Ft.
L _s	Length of shell (or length of one tube pass)	Ft.
M	Molecular weight	Lb./mole
n	Number of tubes in parallel	None
N _{PT}	Number of passes tube side	None
P	Pitch or spacing of baffles	In.
ΔP	Pressure drop	Lb./sq. in.
R	Parameter of ΔT correction chart	None
s	Specific gravity referred to water	None
t	Temperature on tube side	Deg. C. or F.
T	Temperature on shell side	Deg. C. or F.
ΔT	Temperature difference	Deg. C. or F.
W	Rate of flow of fluid	Thousands of lb./hr.
z	Viscosity	Centipoise
μ	Viscosity	Lb./hr./ft.

Subscripts

Subscripts	Designations
i	Refers to tube side
o	Refers to shell side
d _i	Refers to inside diameter of tube
H	High
L	Low
M	Corrected mean
LM	Log mean
MTD	Mean temperature difference
n	Numerical
m	Mechanical design
p	Physical property
w (on chart)	Work
w (in text)	Tube wall or tube material
s	Refers to scale or fouling material

Examples

F_{P1} = Physical property factor for tube side fluid
 f_{d1} = Factor in pressure drop equation representing (5.4 d_i)^{1.8}
 t_H = High temperature on tube side

changers of considerably higher cost for equivalent surface. A good rule of thumb is to fix the exchanger at the lowest number of shell passes for which the correction factor is 0.8 or higher.

One way to start specifying the mechanical design factors is to pick the smallest tube diameter consistent with established practice to get the maximum velocity and minimum film resistance.

Established practice specifies $\frac{3}{8}$ in. tubes as the smallest for non-fouling conditions. A diameter of 1 in. or more is required for cleaning tubes that may foul. For the shell side, minimum baffle pitch is $\frac{1}{4}$ the shell diameter, maximum is the shell diameter.

After picking a diameter, the number of tubes may be arbitrarily selected. As a first approximation, use:

$$n = W_1/2d_i z_1$$

Pick any practical tube length between 20 and 50 ft.: make it a multiple of the shell length if that's fixed.

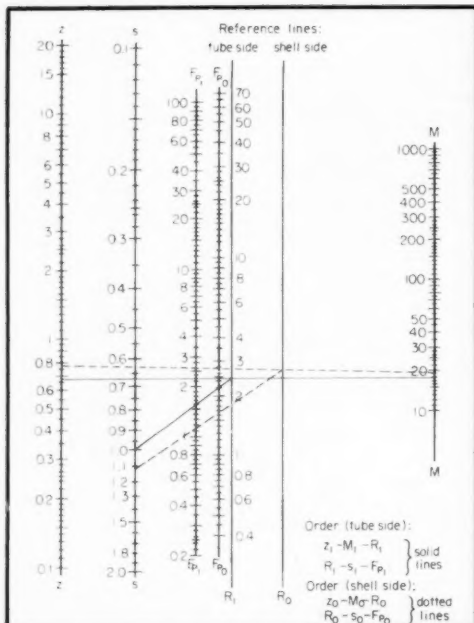
If the sum of products is not close to 1, multiply the tube length by the sum of products to get the corrected tube length. It is customary to use standard tube lengths in even multiples of two feet. The sum of products should be as close to 1 as the manufacturers' standard tube count⁸ will bring you.

A heat exchanger has now been specified that will do the job as far as heat transfer is concerned, and checking of pressure drops is now in order. This will result in fixing the number of tubes at the minimum consistent with pressure drop limitations.

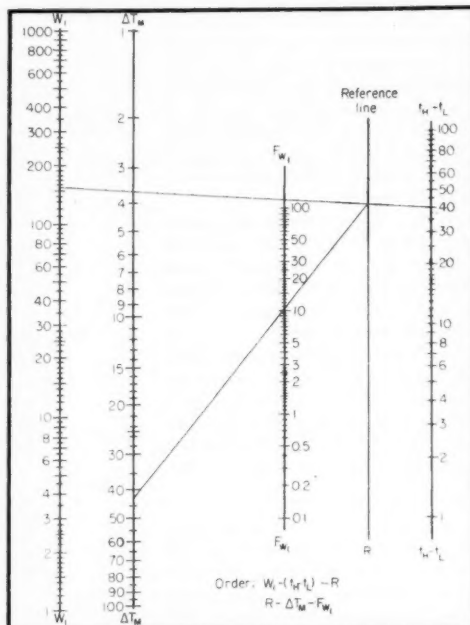
Space on the computation sheet is set aside for determination of pressure drop. Refer to Eqs. VI and VII.

(Continued on page 148)

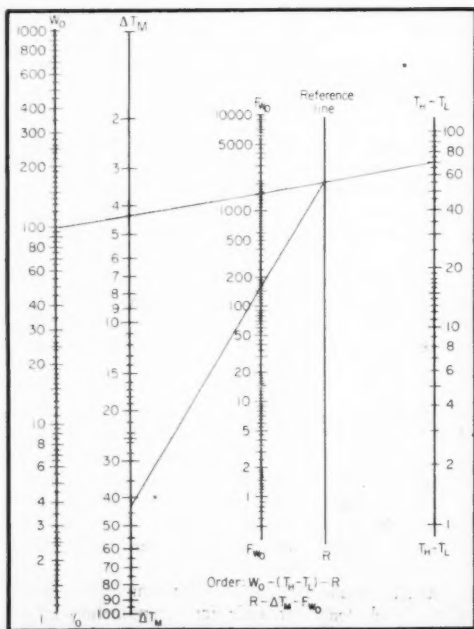
Nomographs for Use with Heat Exchanger Computation Sheet (p.148)



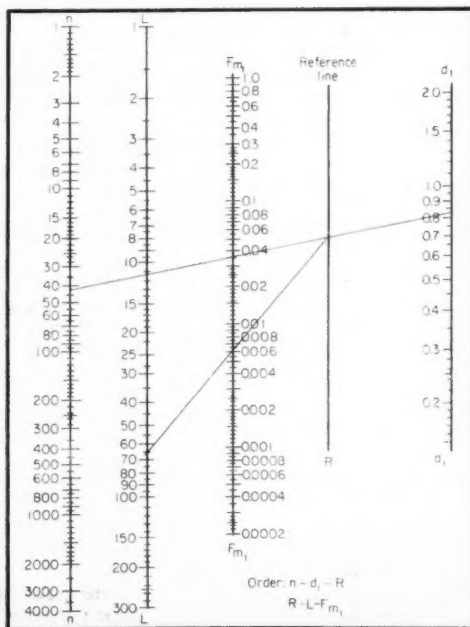
Physical property factors for liquids (heat transfer).



Work factor for tube side fluid (heat transfer).

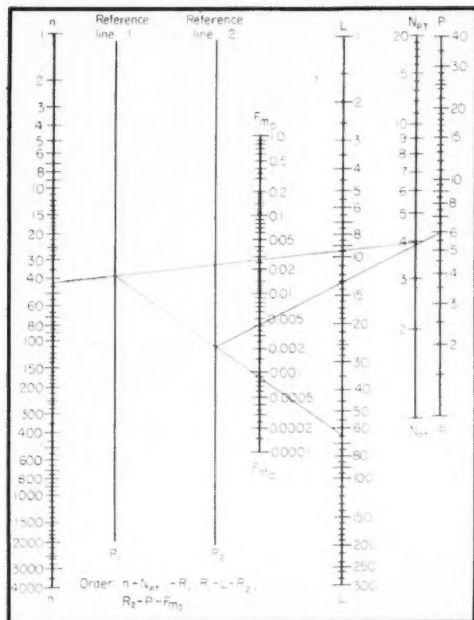


Work factor for shell-side fluid (heat transfer).

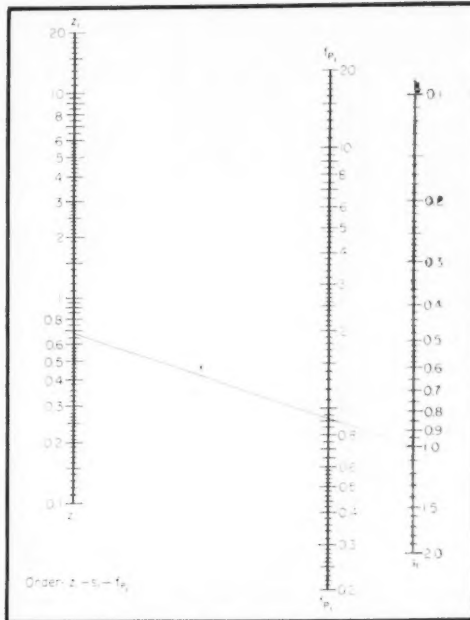


Mechanical design factor for tube side fluid (heat transfer).

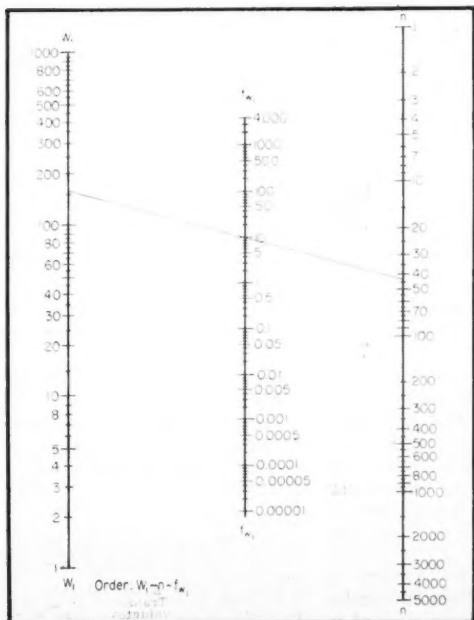
Nomographs for Use with Heat Exchanger Computation Sheet (p.148)



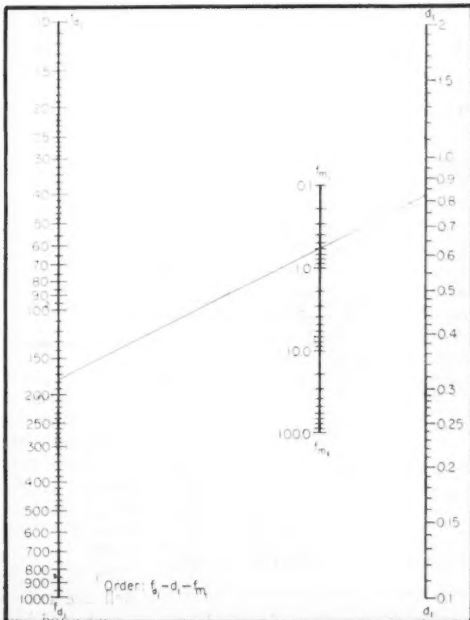
Mechanical design factor for shell side fluid (heat transfer).



Physical property factor for tube side fluid (pressure drop).



Work factor for tube side fluid (pressure drop).



Mechanical design factor for tube side fluid (pressure drop).

EXAMPLE

The figures inserted in the computation sheet are those used in the solution of the following problem:

Design an exchanger to cool 100,000 lb. per hr. of 15 deg. Be. caustic solution (sp. gr. of 1.115) from 190 deg. F. to 120 deg. F. using water at 80 deg. F. Use a combined dirt factor of 0.002 and allowable pressure drops of 10 psi. Viscosity of the caustic solution is 1.4 centipoises at 100 deg. F. and 0.43 centipoises at 210 deg. F. For the specific heat assume the dry salt to have a value of 0.25 Btu. per lb., giving a specific heat for the solution at the mean of 0.88.

Plant practice permits the use of triangular pitch with 1 in. O.D. tubes for solutions in which the scale may be boiled out. Inside diameter of tubes: 0.834 in. (#14 BWG).

The solution to this problem would normally only be obtained by making at least three trial solutions oscillating between trials on the heat transfer factors and those for the pressure drop until a satisfactory solution is obtained for both heat transfer and pressure drop.

It is not always possible to meet pressure drop stipulations on both sides of a heat exchanger. In this example the full pressure drop on the shell side has been met by reducing the baffle pitch to 6 in. but the pressure drop on the tube side is only about half that which was allowed. This is about as close as you can get to allowable pressure drop on the tube side because more passes would result in too great a pressure loss.

For those who desire to know the approximate magnitude of the heat transfer coefficients for the individual films, these may readily be obtained after the design is completed by dividing the overall coefficient (obtained in the conventional manner) by the final heat transfer factor for each resistance. In the example, the overall coefficient is:

$$\frac{154,000 \times 1 \times (120-80)}{715 \times 43.5} = 198$$

The film coefficient is approximately:
For tube side $198/0.252 = 785$
For shell side $198/0.286 = 695$
For tube wall $198/0.053 = 3740$
For scale $198/0.40 = 495$

CAUTIONS

The design method described here is to be used only when the Reynolds

HEAT EXCHANGER COMPUTATION SHEET								
For conditions of no phase change, forced convection, turbulent flow, cross flow in shell								
HEAT TRANSFER CALCULATIONS								
		Tube side		Shell side		Fouling		
Numerical factor F_n	Gas		Liquid		Tube spacing		159	
	Tri.	Square	Tri.	Square	Tri.	Square		
	2.48	0.475	0.604	0.342			3820	
	2.62	0.270						
Liquid physical property factor F_p	Z_1	0.68	Z_2	0.76	C_1	26 (steel)	C_2	1
	M_1	1.8	M_2	1.1	h_s		h_s	500
	S_1	1.0	S_2	1.15	C_1/k	1/26	C_2/h_s	1/500
	F_{p1}	1.6	F_{p2}	1.65				
For gases—Omit this factor								
Work factor F_w	W_1	154	W_2	100	W_1	154	W_2	154
	T_{H-TL}	40	T_{H-TL}	70	T_{H-TL}	40	T_{H-TL}	40
	ΔT_M	43.5	ΔT_M	43.5	ΔT_M	43.5	ΔT_M	43.5
	F_{w1}	10	F_{w2}	160	$W_1(T_{H-TL})$	142	$W_2(T_{H-TL})$	142
Mechanical design factor (see footnote) F_m	n	42.5	n	42.5	d_o	1.000	n	42.5
	d_i	0.834	n_{PT}	4.0	d_i	0.834	d_o	1.00
	L	64	L	64	d_o-d_i	0.166	L	64
	F_m	0.006	F_{m2}	0.004	d_o-d_i	0.166	n_{d_oL}	1
Product $F_n \times F_p \times F_w \times F_m$		0.252		0.286		0.053		0.400
PRESSURE DROP CALCULATIONS								
		Tube side		Shell side		Product tube		
Physical property factor f_p	f_{p1}	0.92	f_{p2}	0.326	f_{p2}	0.292	Product shell	
							Product wall	
Work factor f_w	f_{w1}	10	f_{w2}	10,000			Product fouling	
							Sum of products	
Mechanical design factor f_m	L_o/d_i	19.2	L_o/d_i	19.2			This sum must be equal to or less than 1.	
	U-bend +16	25.0						
	Straight +25	44.2						
	Times N_{PT}	4						
	f_{d1}	176.8	f_{d2}	16				
	f_{m1}	0.58	f_{m2}	216/2125				
		$f_p \times f_w \times f_m = \Delta P$		ΔP per shell		Item No. Cooler for caustic solution		
		5.35		10.15		Surface area: 715 sq. ft.		
		$\Delta P \times \text{No. of shells}$		ΔP total		Size:		
		5.35		10.15		Number of tubes = 170		
MEAN TEMPERATURE DIFFERENCE (CORRECTED)- ΔT_M								
Heating and cooling temperature ranges and abscissa and parameter of ΔT correction factor charts.								
ΔT_H	70	T_H	120	High	190	T_H		
ΔT_L	40	T_L	80	Low	120	T_L		
Differ.	30	T_H-T_L	40	R	0.815	T_H-T_L		
Ratio	1.75	T_H-T_L	110	1-2	0.815	T_H-T_L		
ΔT_{LM}	53.3	T_H-T_L	200	2-4	0.815	T_H-T_L		
F_{MTD}	0.815	T_H-T_L	400	3-6	0.815	T_H-T_L		
ΔT_M	43.5	T_H-T_L	800	4-8	0.815	T_H-T_L		
*Or T_H-T_L whichever is larger positive value								

As a first approximation, a value of n may be obtained from: $n = W_1/2 d_i z$

number of the tube side fluid is above 2,100. When the Reynold's number of the tube side fluid is between 2,100 and 10,000 a correction can be applied, although it is not usually necessary for water and other liquids of low viscosity. Best procedure is to design for Reynold's numbers above 10,000.

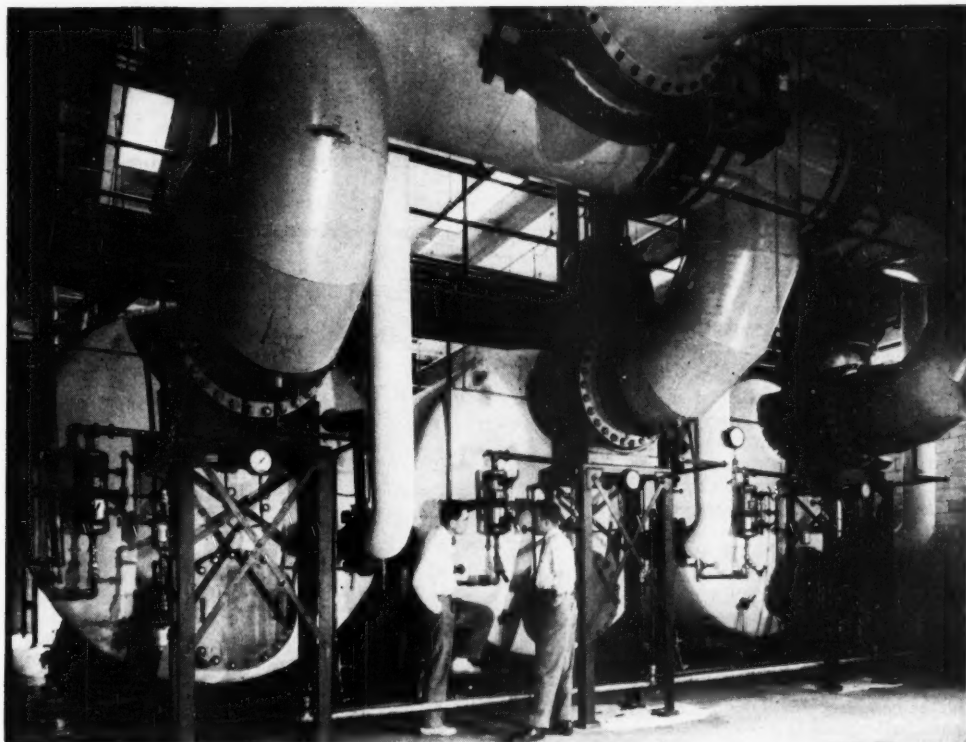
No precautions are necessary on shell side as far as Reynold's number is concerned because the staggered arrangement of the tubes provides tur-

bulence even at very low Reynold's numbers.

The baffle cut should not exceed 25 percent of the shell diameter for suitable accuracy of this system of design.

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2. Trans. A. I. Ch. E., 29, 174, 1933.
3. "Process Heat Transfer," D. Q. Kern, p. 841-842 or *Downingtown Iron Works, Heat Exchanger Catalog 1944.*
4. "Process Heat Transfer," D. Q. Kern, p. 238-ex. 11.3.



A D S O R P T I O N

Improved processes based on new adsorption techniques are being introduced, and more are on the way. This report brings you up to date on what adsorption can do, its mechanism, latest design practice, vapor and liquid phase processes, and expectations for the future.

CHEMICAL ENGINEERING REPORT—OCTOBER 1952

ADSORPTION is one of the so-called unit operations in chemical technology.

It is a unit operation that is fast-growing but not as well-known to the average chemical engineer as some of the others such as absorption, distillation, and extraction.

It warrants a closer look for a number of reasons.

First of all it is uniquely adapted to performing many separations that are otherwise difficult or impossible.

Secondly new techniques are broadening its applicability.

Although selection of adsorbents is presently made on an empirical basis, theory is gradually catching up with the practice. It may not be long before the practice will be improved substantially as a result of contributions from the researchers.

Here in a series of six articles we attempt to present the highlights of the more important phases of the subject. For details, consult the references.

The first article tells how the techniques of adsorption are ideal for difficult separations while comparing adsorption with some of the more familiar separation processes. Liquid phase and gas phase processes are the subject of the second and third articles, respectively. The fourth is concerned with the fundamental aspects of the design of fixed and moving bed units; the fifth—mechanism of columnar adsorption. For what to expect in the future, refer to the sixth article.

ADSORPTION:

Techniques Are Ideal for Difficult Separations

Comparison with the more familiar separation processes such as absorption and distillation serve to point up the special usefulness of adsorption and its limitations.

ROBERT E. TREYBAL, Professor of Chemical Engineering, New York University, New York, N. Y.

Adsorption is a separation operation the techniques of which are not entirely familiar to many chemical engineers, despite the fact that it has been used for many years, and despite its increasingly extensive application in recent times. It is generally recognized as a very powerful device, capable of successful application to some of the most difficult separations both of liquids and of gases. But perhaps because of the variety of process flow sheets, or because of the very different behavior of the many industrial adsorbents, it is not always clear exactly what can be accomplished by adsorption.

In such instances it is useful to compare the characteristics of the unfamiliar operation with those of well known methods, and in that way establish the special usefulness, limitations, and other peculiarities of the unfamiliar.

EQUILIBRIUM

The basis for understanding any of the mass-transfer operations, of which adsorption is one, is a knowledge of the equilibrium characteristics of the systems involved. Let us begin, therefore, with some elementary considerations of equilibrium.

A pure vapor such as benzene may be kept in contact with its liquid indefinitely only under limited conditions of pressure and temperature. For each temperature there is but a single pressure, the vapor pressure, at which any amounts of the two phases may coexist.

On the other hand, if pure benzene vapor is contacted with an adsorbent solid such as activated carbon, at each pressure and temperature a portion of the benzene will become attached or adsorbed to the solid, and although the adsorbed material exists in dynamic equilibrium with the vapor, it has for all practical purposes become immobilized upon the solid. A new phase,

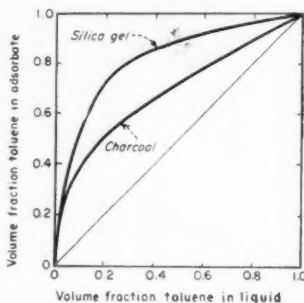


Fig. 1—Equilibrium adsorption, 75 deg. F.

the adsorbed phase or adsorbate, has been created. The equilibrium amount adsorbed per unit weight of solid increases with increased pressure and decreased temperature, each of which may be varied at will, so that in effect the presence of the solid has provided an additional degree of freedom. The same is true if the vapor is mixed with an unadsorbed gas, so that such equilibria are very similar in general behavior to the solubilities of gases in liquids.

If a mixture of two vapors such as benzene and hexane are contacted with an adsorbent solid, both vapors will be adsorbed, and at equilibrium the amount of the adsorbed phase per unit weight of solid will again be dependent on the temperature and pressure. Similarly if a liquid solution of benzene and hexane is contacted with the adsorbent both substances are adsorbed to an extent depending on the temperature. But more important than this, in both cases the composition of the adsorbed phase at equilibrium will be different from that of the fluid.

In each of the mass-transfer operations, we depend upon the different distribution of substances between two phases at equilibrium. In distillation of a binary mixture, for example, a new vapor phase is created from the

liquid by application of heat and the two phases contain both substances in substantial amounts but in different proportions. In gas absorption the new phase is provided by the solvent liquid, and ordinarily the liquid phase contains substantially only one of the components of the original gas phase. It is convenient to compare adsorption with these more familiar vapor-liquid operations, provided that we do not overlook certain of the essential differences.

Fig. 1 illustrates the equilibrium compositions obtained when liquid mixtures of toluene and iso-octane are contacted with two different adsorbents¹.

The curve for each adsorbent is similar in shape to the very familiar McCabe-Thiele x-y diagrams used in distillation design. Here the increased departure of the curve from the 45 deg. diagonal indicates greater relative volatility or ease of separation. In adsorption the greater departure shown by the silica gel indicates that it is the more selective of the two adsorbents, or the more effective in making a separation of the two substances. In distillation of this mixture there is but one equilibrium curve at this temperature, and the fact that different curves for the same mixture are obtained with different adsorbents indicates how much more powerful a separation method adsorption can be: it is as if we had several kinds of heat in distillation with which to create a new phase.

Some of the adsorbents are selective according to molecular weight, making it possible to separate mixtures like ethylene-propylene, for example. Others are selective according to chemical type, making it possible to separate a mixture like benzene and cyclohexane which, since these substances form an azeotrope, cannot be separated by the ordinary distillation procedure.

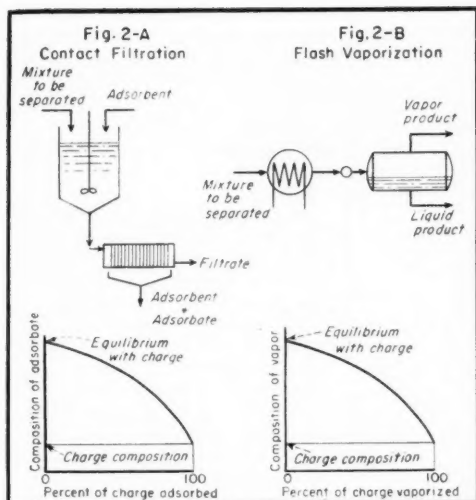


Fig. 2—Analogy between contact filtration and flash vaporization.

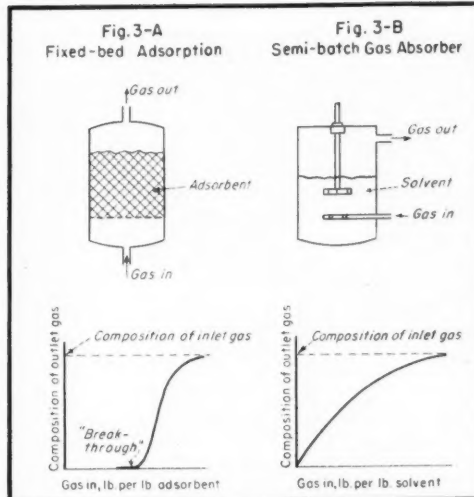


Fig. 3—Analogy between fixed-bed adsorption and gas absorption.

In addition to selectivity, the capacity of the adsorbent, or the amount of adsorbed phase per unit weight of solid, is of engineering importance. Just as in distillation where it is desired to be able to create a vapor phase with the expenditure of a small amount of heat (low heat of vaporization), so in adsorption high capacity is preferred in order to reduce the quantity of solid material which must be used.

Unfortunately it often happens that high selectivity for an adsorbent is accompanied by low capacity, and an economic balance is then necessary in making a choice between adsorbents.

CONTACT FILTRATION

If a small amount of silica gel is stirred into a quantity of the toluene—iso-octane solution mentioned above and allowed to come to equilibrium, a small amount of liquid will be adsorbed and the adsorbed phase will be richer in toluene. The solid may then be filtered from the liquid as in Fig. 2a, the adsorbed material removed from the solid by steam stripping, and the toluene-rich product collected. This operation, known as contact filtration, is very similar to the well known flash vaporization process of distillation, Fig. 2b.

For example, in flash vaporization, the larger the portion of vapor that is formed, i.e., the more heat we add,

the more nearly will the vapor phase resemble the original mixture in composition, until finally if the entire mixture is vaporized, vapor and original liquid have the same composition and no separation results. Similarly in contact filtration, the more adsorbent that is added, the greater the total amount adsorbed but the more nearly the adsorbed composition resembles the original liquid. Eventually, should enough solid be added, the entire liquid would be adsorbed and no separation would be obtained.

This is shown to be true by the curves of Fig. 2, which are exact counterparts. We may reason from distillation experience that contact filtration is a single stage operation and that it may be carried out in either batch or continuous fashion. The stage efficiency, or approach to equilibrium that is obtained, is dependent upon the intimacy of contact of the phases, but in any case equilibrium between the residual liquid and the adsorbed phase represents the best separation that can possibly be expected.

Contact filtration is probably most frequently applied when relatively small amounts of a substance must be removed from relatively large amounts of a liquid, as in decolorizing sugar solutions. Here the exceptionally high selectivity of the adsorbent for the colored matter permits satisfactory separation with but a single stage. The separation to be expected for a

mixture like toluene-iso-octane, on the other hand, would be a relatively poor one.

PERCOLATION; FIXED-BED ADSORPTION

In percolation adsorption, a liquid mixture to be separated is allowed to trickle through a bed of solid adsorbent. Alternatively, a gas mixture may be caused to flow through such a bed to bring about a separation. In analyzing what to expect from such a procedure, let us first examine a simple gas-liquid operation that in some ways is similar.

Suppose a gas mixture such as SO_2 -air were to be introduced continuously into the bottom of a tank of water which is perfectly agitated so as to maintain always a uniform composition throughout, as in Fig. 3b. The SO_2 in the gas mixture entering will dissolve in the liquid, and at the resulting liquid concentration there will be an equilibrium partial pressure of SO_2 in the air issuing from the top of the tank. Only the first infinitesimal portion of air delivered at the top will be SO_2 -free. As more gas is passed in at the bottom the concentration in the liquid increases, eventually coming to equilibrium with the entering gas. In the meantime the SO_2 concentration in the air leaving has steadily increased until it reaches the concentration of the entering gas, as shown in the curve of Fig. 3b.

If, however, the SO_2 -air mixture is passed continuously into a fixed bed of silica gel, as in Fig. 3a, the lowest part of the solid bed immediately adsorbs the SO_2 (the air is not adsorbed). Since the capacity of the solid for SO_2 is high, the SO_2 escaping into the upper part of the bed is practically non-existent.

Air leaving the top is therefore, for all practical purposes, pure, and continues to be so until nearly all but the top of the bed becomes saturated with SO_2 . Only then does SO_2 "break through," whereupon the SO_2 content of the exit gas rapidly rises to the value in the entering air, as in the curve of Fig. 3a.

The advantage of using adsorption for providing pure air is obvious. This "break-through" characteristic is a result of the immobility of the fixed-bed adsorbent. As might be expected, the amount of air that can pass through before SO_2 appears in the effluent will be greater the taller the bed, less if the bed is shorter. If the adsorbent were fluidized, however, so that a uniform concentration of adsorbed substance were maintained throughout from the beginning, SO_2 would be present in the effluent air from the outset. Percolation of liquids through an adsorbent, as in the Arosorb process for separating hydrocarbons, shows much the same characteristics as fixed-bed adsorption of gases.

If, after the SO_2 saturates the water (Fig. 3b), CO_2 is passed into the tank, the CO_2 will displace the SO_2 and itself dissolve; or the SO_2 may be expelled by heating the water. Similarly the SO_2 adsorbed on the silica gel may either be displaced by another gas or removed by heating. Both of these methods are used in recovering the adsorbed substance from the solid material.

CONTINUOUS FRACTIONAL ADSORPTION

If a liquid mixture such as benzene and hexane is placed in an ordinary laboratory distillation flask and distilled, the first infinitesimal portion of vapor formed is in equilibrium with the charge liquid, and is thus slightly richer in the more volatile hexane. As more heat is applied and the distillation is continued, the concentration of the distillate becomes continuously less rich in hexane. The richest distillate is obtained only if an infinitesimal portion is taken, and at best it is merely

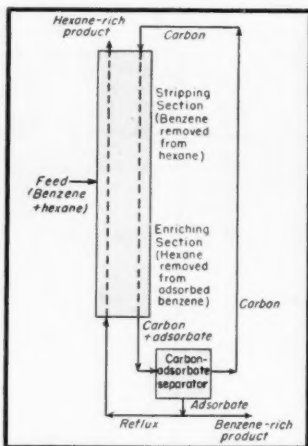


Fig. 4—Continuous fractional adsorption.

in equilibrium with the charge. To improve the yield and composition of product, and at the same time make the process continuous, we use the familiar fractional distillation, or rectification. This is a multi-stage process where the feed is introduced centrally into a tower and the vapors which rise are washed free of the high boiling substance by a counterflow of reflux, while the liquid which runs down the tower is stripped of its volatile material by a counterflow of vapor from the reboiler. The resulting products may be as pure as we desire.

Processes such as these have their counterparts in adsorption as well. For example, if adsorbent carbon is permitted to fall continuously through a batch of benzene-hexane solution, the process is exactly similar to the simple laboratory distillation. The carbon preferentially adsorbs the benzene, and the first carbon to reach the bottom of the solution contains adsorbate in equilibrium with the charge liquid. As more carbon passes through the solution, the concentration in the adsorbate becomes less and less rich in benzene. The enrichment is too poor to make such a process worthwhile.

If, however, the feed solution is continuously introduced centrally into a column down through which a moving bed of carbon continuously passes, as in Fig. 4, the adsorbed benzene and hexane are carried downward. If the carbon removed from the bottom is freed of its adsorbate which is then partly returned to the column to flow upward, the more readily removed

hexane will be preferentially removed from the carbon and flow upward in the liquid phase. The bottom product will thus be nearly pure benzene. Above the feed, the rising hexane-rich solution is stripped of its benzene by the counterflowing carbon, thus producing a nearly pure hexane product at the top.

Such a device is comparable to a distillation column operating upside down, since the carbon acts as the analog of heat. The carbon entering the top is similar in its action to the rising vapors in the stripping section of a distillation tower. The adsorbate returned at the bottom is reflux. Various devices may be used to provide the reflux. For example, the carbon can be heated, or steam-stripped, or the adsorbate can be displaced by another hydrocarbon such as pentane, for example.

Although a liquid separation was used for convenience in describing the process, the method has been extensively used for separating gases, as in hypersorption, but the principles are the same for both gases and liquids. In either case we have a multi-stage device capable of providing two products each much richer than merely in equilibrium with the feed. The separation obtained can be measured in terms of an equivalent number of ideal stages (like ideal trays), there will be a minimum number of ideal stages corresponding to total reflux, a minimum reflux ratio corresponding to an infinite number of stages, and many characteristics which are familiar to all who have worked with fractional distillation.

There are other separation processes involving adsorption such as chromatography, partition chromatography, and the like. These too can be related to the more familiar separation operations in attempting to understand their characteristics. The use of analogs in this manner, if carried too far, will eventually fail because of the special peculiarities of each process. Nevertheless it is sincerely hoped that this discussion, as an introduction to the more comprehensive and technical articles which follow, has been helpful in indicating what generally may be expected from adsorption as a separation method.

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1. Eagle, S., and J. W. Scott, *Ind. Eng. Chem.*, 42, 1287, 1950.

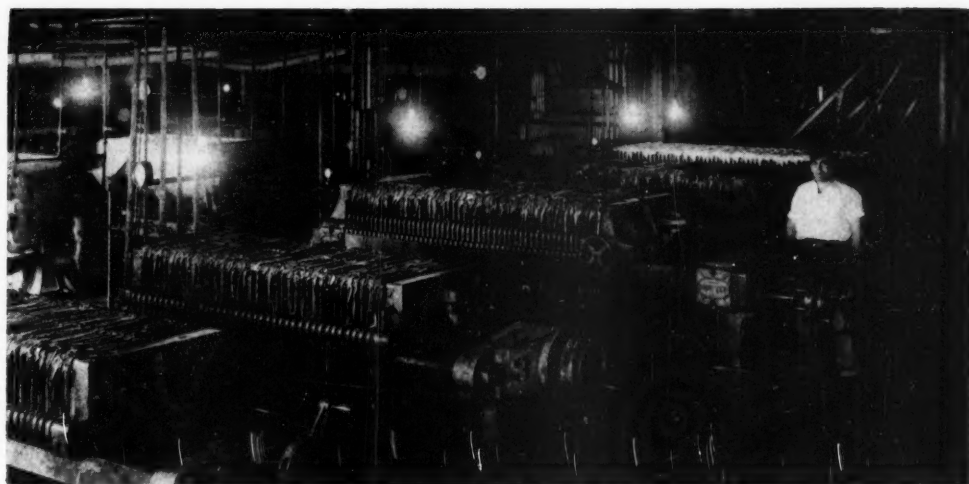


Fig. 1—Filter presses in a beet sugar refinery used to separate out carbon and its adsorbed impurities from clear sugar solution.

ADSORPTION:

Liquid Phase Processes Are Important

Selection of the proper adsorbent, effect of process variables on efficiency of adsorption, and adsorbent regeneration for liquid phase systems.

WALTER A. HELBIG, Chemical Engineer, Darco Department Atlas Powder Co., New York, N. Y.

Adsorption from the liquid phase is invariably adsorption from solution since it involves removal of an adsorbate from a solvent by transfer to a liquid-solid interface.

The concentration of adsorbate that can be so removed ranges from very low values—parts per million—in the removal of odor and taste causing substances from potable water, to very high concentrations in the selective adsorption of aromatic from saturated hydrocarbons.

Within this range of solute concentrations, adsorption from solution can be used to achieve a variety of objectives. These fall into two broad classes: (1) purification (limited to low concentrations) by adsorption of impurities causing color, odor, taste, haze, or other objectionable effects such as foaming or inhibition of crystallization, and (2) isolation (less limited as to concentration) by adsorption of a desired solute and its subsequent desorption by suitable means.

Choice of Adsorbent

TYPE

The chemical engineer planning to use an adsorbent for liquid phase work is concerned with a rational basis for choosing the material best suited.

For adsorption from water solution, activated carbon is almost without exception the most suitable adsorbent. Activated clays, aluminas, magnesium silicates, and silica gels are seldom effective in aqueous media. Carbon is not, however, confined to use with water solutions; it has a broad "spectrum" of applicability which includes the alcohols, esters, hydrocarbons and their chlorinated derivatives, glyceride and petroleum oils, waxes, and most other organic liquids and liquefiable substances.

The non-carbonaceous adsorbents are effective in non-aqueous media. Commercially, their widest applications are in the decolorization of vegetable, animal, and mineral oils. The

various clays (natural and acid-activated) are the most commonly used. For special cases, such as reclamation of transformer oils, activated alumina is used.

Adsorbent clays are frequently used in conjunction with activated carbons. On vegetable oils, for example, the two adsorbents are complimentary, each adsorbing color bodies not effectively removed by the other.

For the special case of removing trace quantities of water from water-immiscible liquids, silica gel is normally preferred. In many cases, however, activated alumina or activated carbon is quite effective. For removing trace quantities of immiscible liquid from water, activated carbon is satisfactory.

FORM

Having chosen a given adsorbent, the chemical engineer is next concerned with deciding whether to use it powdered or in granular form.

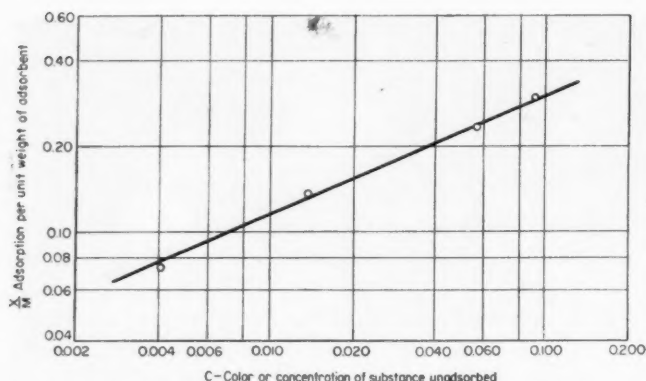


Fig. 2—Adsorption isotherm for evaluation of a powdered adsorbent (See Table I).

Powdered adsorbents are applied by stirring with the liquid to be treated until adsorption equilibrium is reached; granular adsorbents, by percolating the liquid to be treated through a fixed bed of the adsorbent.

A number of considerations enter into the choice between a powdered or granular adsorbent:

1. *Efficiency.* Pound for pound, a powdered adsorbent is more efficient than the same material in granular form because the former presents a greater accessible adsorptive surface. The difference may be two to four-fold, with large granules.

2. *Concentration of solute to be adsorbed.* The lower the concentration of solute to be adsorbed, the longer will be the effective life of a bed of granular adsorbent. In the treatment of industrial water supplies, for example, where the adsorbate consists of chlorine at parts-per-million concentration, and even lower concentrations of organic impurities causing taste and odor, a bed of granular activated carbon operated at 1 gpm. per cu. ft. of carbon will normally give a life of one year or longer without any regeneration.

On the other hand, since the adsorbate-adsorbent weight ratio is seldom greater than 1:10, a solution containing as little as 0.1 percent concentra-

tion to be adsorbed would spend a granular bed in about 4 hr.

The 0.1 percent concentration would call for at least 1 percent carbon or, roughly, 1 lb. to 12 gal. solution. Since carbon weighs 20 lb. per cu. ft., a cubic foot of carbon would suffice for 240 gal. If the percolation rate were 1 gal./cu. ft./min., the useful life would be 240 min. Similar calculations would apply to other adsorbents.

Such a short bed life would normally lead to a decision to use the adsorbent in powdered form. Although this involves the necessity of a filter station to remove the suspended solid, it usually requires less labor and "down" time to open and clean a filter, than to clean out and replenish a granular adsorbent bed.

3. *Possibility of regenerating the spent adsorbent.* A short granular adsorbent bed life is permissible, in terms of operating cost, if the adsorbent can be regenerated easily, and, if possible, without removing it from the bed. Regeneration is described in greater detail below.

4. *Clarity of liquid being treated.* Suspended matter in a liquid to be percolated through a bed of granular adsorbent tends to foul the granules, and thus to impair access to their internal adsorptive surface. I have

witnessed a case in which a bed of granular activated carbon for water treatment, which normally should have given at least one year's service, became ineffective in 18-hr. because the water had a turbidity of only 25 ppm. Powdered adsorbents are not adversely affected by suspended solids, except in fairly large amount.

EFFICIENCY—POWDERED ADSORBENTS

Another problem facing the chemical engineer planning to use an adsorbent is evaluation of adsorption efficiency. Theoretically, efficiency depends upon the specific area of the adsorbent, the nature of that area, and the accessibility of the area—a matter of micro-pore size distribution. As a practical matter, the only evaluation procedure that has any meaning is a test with the adsorbent on the liquid to be treated.

For evaluation of powdered adsorbents, the empirical Freundlich¹ adsorption isotherm (Fig. 2) is useful. The equation for this is most commonly written:

$$\frac{X}{M} = KC^{1/n}$$

where X represents units of substance adsorbed, M is weight of adsorbent effecting this adsorption, and C is the equilibrium concentration of substance remaining unadsorbed in solution. K and $1/n$ are constants; graphically K is the X/M intercept of the isotherm plot at $C = 1$, and $1/n$ is the slope of the line, when the equation is plotted on logarithmic paper. On such paper the equation is a straight line, since

$$\log \frac{X}{M} = \log K + \frac{1}{n} \log C$$

is a linear equation of the type $y = a + bx$.

Since X/M is adsorption per unit weight of adsorbent, it may be considered as an expression of concentration of adsorbate on the adsorbent, and the equation is therefore a distribution equation: a concentration of adsorbate X/M on the adsorbent in equilibrium with a concentration C remaining unadsorbed.

Although the Freundlich equation is empirical, long experience has shown that it describes correctly adsorptions over a wide range of conditions. It is applicable with aqueous and non-aqueous media, and with carbonaceous and non-carbonaceous ad-

Table I—Adsorption of Benzoic Acid from Water by Activated Carbon

M	C	X	X/M
Weight of Adsorbent Used	Color or Concentration of Substance Unadsorbed	Amount Adsorbed ($C_0 - C$)	Adsorption per Unit Weight of Adsorbent
0.0	0.1500 (C_0)
0.2	0.0900	0.0600	0.3000
0.4	0.0560	0.0940	0.2350
1.0	0.0136	0.1364	0.1364
2.0	0.0040	0.1460	0.0730

Column 2 is plotted vs. column 4, on logarithmic paper, with C as abscissa and X/M as ordinate.

sorbents. This dependability makes it useful not only for evaluation, but also as an index of abnormal adsorption phenomena.³ Furthermore, it is not restricted to cases where the concentration of adsorbate in solution can be measured; C and X may be in any units which are linearly proportional to concentration, such as color³ units based on a dilution scale (e.g., the APHA scale, but not the Gardner scale), odor intensities measured by the threshold odor method,⁴ or optical densities at a suitable wave length transmission obtained by spectrophotometric measurement — not necessarily in the visible spectrum. For color or odor measurements, it is of course necessary that the color of odor in question follow Beers dilution law.

To secure data for plotting the Freundlich isotherm, the procedure is briefly as follows:

To a series of at least five samples of the liquid to be treated are added weighed amounts of adsorbent as indicated in Table I. One sample is a blank with no adsorbent added; this is carried through the same procedure as the others and serves as the indication of original adsorbate concentration, C_0 . The samples are stirred actively for at least 15 min. to insure reaching adsorption equilibrium, at that temperature at which the adsorbent will be used in actual plant operation. (Precise maintenance of temperature is not essential as will be discussed later). The samples are then filtered, and the clear filtrates are subjected to measurement of unadsorbed substance concentration C by whatever means are pertinent. These values are then subtracted from C_0 concentration in the blank sample to give X , the amount adsorbed, by difference. X/M is then obtained by simple division.

This procedure is vastly superior to running "single-point" tests. A single point test is one point on an adsorption isotherm; it reveals nothing of the nature of the adsorption. The isotherm indicates, first of all, whether the adsorption proceeds with ease or with difficulty—a shallow slope indicates good response to adsorption, and a steep slope, a difficult adsorption. Values of $1/n$ from 0.1 to 0.5 are considered good; 0.5 to 1.0, moderately difficult. A value of 2 or more for $1/n$ indicates very poor adsorption; the X/M values fall off very rapidly



Fig. 3—Carbon treatment tank and filter press in a chemical plant.

with decreasing C values, and low values of C can be reached only with impractical adsorbent dosages.

A further advantage of the isotherm lies in the possibility of comparing adsorbents.^{3,4} To be valid, such comparisons should be made at a fixed C value, usually the residual concentration that may be permitted, for cost or operating reasons, to remain in the liquid after treatment. A series of adsorbents, tested on a given liquid, rarely give parallel adsorption isotherms; their relative efficiencies will vary therefore with the C value at which comparison is made. The actual comparison is the ratio of X/M values for each adsorbent, read from the isotherms at the chosen C value.

Another useful property of the adsorption isotherm is that from it may be calculated correctly the dosage of adsorbent required for counter-current⁵ or split-feed⁶ application. Recourse to such treatment may be necessary if single stage application of even the most efficient adsorbent in a given case calls for excessively large dosages. Countercurrent or split feed applications are advantageous with steep adsorption isotherms; the savings in adsorbent may range as high as 75 percent, or even 90 percent.

EFFICIENCY—GRANULAR ADSORBENTS

In the evaluation of granular adsorbents, a common testing method consists in percolating the liquid to be treated, again at the same temperature as in plant operation, thru a laboratory column of the adsorbent. This column should contain the same depth of adsorbent, and should be operated

at the same rate, as is planned for large scale use. The reason for this is that unless adsorption equilibrium is assured there is not at present any reliable general mathematical relationship between results obtained at one bed depth and flow rate, with those obtained at another set of conditions.

Bed depths in practice vary from the 30 in. commonly used in water purification, to the 15-20 ft. in bone-char towers for sugar refining.⁷ Flow rates range from 1 gal./min./cu.ft. of adsorbent used for water purification to 0.015 to 0.025 gal./min./cu.ft. for sugar liquor in bone-char towers.

When granular adsorbents are evaluated by direct percolation tests, comparisons are based on the volume of liquid that can be satisfactorily treated before a given concentration of adsorbate passes thru with the effluent.

In many cases, the time required for such a test may be excessively long, either because very low adsorbate concentrations lead to a long bed life, or because of very low percolation rates. In such cases, a reasonably good first order approximation can be obtained by grinding the adsorbent, and proceeding, as with powdered adsorbents, to obtain an adsorption isotherm. From the isotherm the dosage required to give a C value equal to the permissible break-thru concentration in column operation is calculated. The volume of liquid that can be percolated thru a bed of given dimensions is then computed by simple proportion.

This procedure is subject to two sources of error, which fortunately tend to balance out. An adsorbent in powdered form is more efficient than

in granular form; the bed life predicted by the isotherm method is therefore longer than is to be expected. On the other hand, column percolation has the characteristics of continuous counter-current operation. On its way thru the bed, liquid of diminishing concentration comes into contact with adsorbent of increasing adsorptive capacity, until the bed is uniformly spent. This counter-current feature tends to offset the greater inherent efficiency of the adsorbent in powdered form. The isotherm method of estimating bed life is particularly useful in reaching a decision as to whether a granular or powdered adsorbent is the more practical to use in a given case.

Process Variables

Having chosen the most efficient adsorbent for his needs, the chemical engineer is concerned with establishing optimum application conditions for its use, and with the equipment required.

The variables involved are primarily temperature and contact time. In his evaluation of adsorption efficiency, he has necessarily had to keep these constant at arbitrary values, chosen in accordance with known operating conditions and his best judgment of probably satisfactory magnitudes. In many cases it is desirable to explore them more closely.²

EFFECT OF TEMPERATURE

When the adsorbate is non-volatile, temperature is not a critical variable. In general, it is advantageous to treat at elevated temperature, because the consequent viscosity reduction favors increase in rate of adsorption, and facilitates filtration or percolation. The upper limit of temperature is usually dictated by the nature of the liquid to be treated; e.g., obviously temperatures at which decomposition of solute being purified occurs should be avoided.

With volatile adsorbates, increase of temperature displaces the adsorption equilibrium in the direction of desorption. Such adsorptions are usually best conducted at room temperature or below; it is well to remember that deodorization by adsorption belongs in this class. Odors are perceptible because they are caused by volatile compounds.

CONTACT TIME AND EFFICIENCY

Contact time and contact efficiency are merely different aspects of the same variable. Adsorption can occur only from liquid in direct contact with the adsorbent; it is not a long-range phenomenon. In the immediate vicinity of the adsorbent, adsorption is known to occur very rapidly.

With powdered adsorbents stirred with a liquid, time is required to bring the suspended tiny particles (the count may be as high as 1×10^{11} particles per gram) into contact with all parts of the liquid. The agitation required is not violent, but it must be turbulent: the essential condition is that the particles be made to move thru the liquid, and not with it.

At ordinary industrial dosage levels, (0.1-2.0 percent adsorbent on weight of liquid) adsorption equilibrium is normally reached in 10-15 min. Longer time is required if the liquid is appreciably viscous—30 min. is desirable with sugar liquors of 60-70 percent concentration at 180-200 deg. F. A longer contact time is necessary also at very low adsorbent dosages, as each particle must then "sweep" an appreciably larger volume of liquid. In the treatment of municipal water supplies with powdered activated carbon, for example, dosage levels are in parts per million, and time required to get to equilibrium ranges from 4-16 hr.

There is one method of using powdered adsorbents, not heretofore mentioned, that combines very efficient contact with short contact time. This is the so-called "precoat" method, in which the adsorbent is deposited as a precoat, varying in thickness from $\frac{1}{4}$ to 2 in., onto a filter from a slurry in a suitable liquid. The liquid to be treated is then pumped thru this precoat. The efficiency of contact in this process is superior to that obtained by percolation thru a bed of granular adsorbent. Contact time thru a 1 in. cake at 10 gal./hr./sq. ft. of filter area is 3.75 min. The method provides a semi-continuous way of using a powdered adsorbent, and obviates the need for an agitator-equipped treatment tank. It also lends itself to counter-current use.

Industrially the precoat method is used with activated carbon in the production of liquid sugars, and in maintaining purity of electroplating solutions.² In the dry cleaning indus-

try it is used for continuous purification of dry cleaner's solvent with activated carbon and other adsorbents.

Contact time and efficiency with granular adsorbents depends upon percolation rate thru the bed, upon granule size distribution, and upon the dimensions of the bed. The controlling factor is that the mechanism of percolation adsorption is essentially that of diffusion—adsorbate must pass by diffusion from liquid on its way thru the bed, to liquid within the pore structure of the adsorbent granule, and from this to the adsorptive interface, until equilibrium is reached.

Ideal conditions would therefore be a slow percolation rate, a granule size distribution designed to give a minimum percent of inter-granule voids, and a long column. These are, in fact, the conditions required where the liquid treated is viscous, and diffusion rate may be expected to be low. For bone-char towers in sugar refining, as has been mentioned, the percolation rate is only 0.015 to 0.025 gal./min./cu. ft. of adsorbent, and the bed depth is 20-28 ft. So far as granule size distribution is concerned, this has to be a compromise between the ideal of minimum void space, and resistance to flow of the viscous solution. Bone char commonly runs 16×30 mesh. In operation, it is customary to have moderate pressure (15-25 ft. head of sugar liquor = 10-15 psi.) applied to secure the desired flow rate.

With water, the picture is quite different. Here the liquid is of low viscosity, and satisfactory results can be obtained at much higher rates—1 gal./min./cu. ft., and with much shallower beds—30-36 in.

In the Arosorb process,³ which uses silica gel in a static bed for selective adsorption of aromatic from saturated hydrocarbons, the objective is to secure 95-97 percent adsorption from a high concentration of adsorbate, at reasonable throughput rates. Although the viscosity is low, the aromatics adsorbate concentration may run 25-27 percent; accordingly, high contact efficiency and a deep bed are necessary. The silica gel used is 28×200 mesh, and the bed depth 15-20 ft. The percolation rate is 0.1 gal./min./cu. ft. of adsorbent. It should be mentioned that this process operates on a 30 min. charge (adsorption) period, a 10 min. displacement period

with butane or pentane, and a 40 min. desorption period with xylene. It is an excellent example of granular adsorption with very short bed life, which is economical because regeneration (desorption, in this case) is easily effected in situ by means of a solvent. Complete restoration of the bed is dependent upon absence of "gel poisons"; the most important of these is water, which may not exceed 20 ppm. in the feed and is removed in a preliminary step. Other poisons are nitrogen, sulphur, and oxygen compounds. With catalytic reformates, these are supposed to be of minor importance. Information on the practical life of a bed is not yet available, but is estimated to be at least one year.

Regeneration of Adsorbents

Cost considerations in connection with the use of adsorbents may lead the chemical engineer to study the advisability, and possibility, of regenerating the adsorbent for reuse. The term regeneration, in this discussion, is limited to removal of adsorbate without recovery, the only objective being the restoration of the adsorbent to its original adsorptive capacity, or as nearly so as may be practical. In regeneration, the adsorbate is frequently destroyed. Operations for recovery of valuable adsorbate without destruction are properly called elutions; these utilize either chromatographic technique, or the little understood, trial-and-error methods formerly employed for elution of antibiotics from activated carbon.

Regeneration methods may conveniently be divided into two classes: in situ methods, in which regeneration is effected without removing the adsorbent from the bed in which the adsorption cycle takes place, and ex situ methods, which usually involve burning off the adsorbate. In situ methods are of course applicable to granular adsorbents only.

REGENERATION BY SOLVENTS

The simplest in situ regeneration method is extraction of the adsorbate by a suitable solvent or mixture of solvents. A good example of this method is the regeneration of spent granular fuller's earth which has been used to decolorize rosin.*

Rosin decolorization is effected in

naphtha solution. Regeneration comprises two steps—first, leaching out the adsorbed color bodies with a mixture of naphtha and alcohol, and second, displacement of this mixed solvent with naphtha alone. Substantially complete regeneration is secured.

STEAM REGENERATION

Another in situ regeneration method is the use of steam or other hot gases or vapors. This has rather limited application for adsorbents used on liquids; it is ineffective unless the adsorbate is volatile. Hot air should not be used for in situ regeneration of activated carbon, as glow-type combustion is initiated at surprisingly low temperatures—in many cases, as low as 150-200 deg. C.

CHEMICAL REGENERATION

Chemical regeneration functions by hydrolysis or oxidation of the adsorbate. It is sometimes possible to regenerate with reasonable success granular activated carbon which has been used to decolorize sugar liquor, by treatment with a hot 2 percent caustic soda solution. Solution is percolated thru the carbon bed until the effluent is no longer colored, water is used to wash out the caustic until a constant pH is reached, dilute acid serves to wash out residual caustic, and a final water wash brings the bed back into condition for reuse.

REGENERATION BY BURNING

By far the greatest tonnage of adsorbent is regenerated ex situ, by burning off the adsorbate. Industrially, the process is used for regeneration of granular bone char in the sugar industry,* and for both powdered and granular fuller's earth¹⁰ in the vegetable and petroleum oil industries. For a chemical engineer considering this type of regeneration the following economic facts are of interest:

1. Ex situ regeneration by burning requires specialized equipment, of large capacity.
2. Such equipment involves major capital outlay.
3. Savings effected by regeneration are rapidly offset by fixed overhead charges if the equipment is not in substantially constant use.
4. Ex situ regeneration by burning is therefore limited to applications in which the amount of adsorbent used is large enough to provide for con-

stant full capacity use of the regeneration equipment.

Materials of Construction

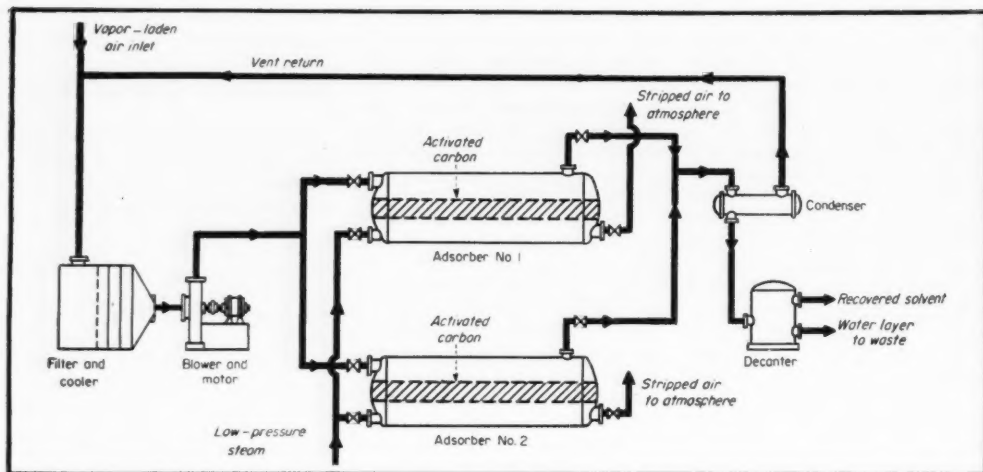
A few words should be said about certain physical properties of adsorbents which affect selection of equipment and materials of construction.

Activated carbons of vegetable origin, especially those which have been washed with acid and water to remove extractable inorganics, are strongly electropositive toward metals. Direct, prolonged contact of such carbons with metals, in the presence of water or other electrically conductive liquid, results in corrosive attack on the metal.¹¹ With granular carbons in unprotected steel filter shells, such corrosion is rapid and destructive. Even with corrosion-resistant steels, there is evidence that attack occurs; while this is not destructive, there is danger of contamination of the liquid being treated by trace quantities of corrosion product. Protection against corrosion is secured by coating the metal in contact with carbon with an inert insulating material. This precaution should also be taken for tanks holding heavy slurries of powdered carbon, e.g. 0.5-2.0 lb./gal. It is not normally necessary for the tanks in which carbon treatment is conducted, as the amount of carbon is too small to provide a mass galvanic effect.

Finally, most powdered adsorbents are quite abrasive. Slurries of activated carbon in water, and bleaching clays in oils, will wear out centrifugal pump impellers fairly rapidly. For carbons, either Duriron or rubber diaphragm pumps are satisfactory. For clays, it is quite common to use reciprocating type steam pumps.

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Flow diagram of solvent recovery plant consisting of two adsorbers without cooling cycle.

ADSORPTION:

Vapor Phase Processes Serve Industry Well

Fixed-bed units are used for solvent recovery, gas purification, and gas dehydration. Moving bed units are now being used for gas separation.

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Vapor-phase adsorption is used for many industrial processes. The important applications covered here are solvent recovery, gas separation, gas purification and gas dehydration.

SOLVENT RECOVERY

Many industrial processes utilize volatile solvents solely as a dissolving medium. The solvents are then vaporized into an air stream. Recovery of these solvents for reuse many times determines whether the process can be operated economically or competitively. Some of the industries where solvent recovery plays an important part are: cellulose acetate rayon, nitrocellulose or other plastic coating of paper or cloth, plastic films and wrappings, rubber products, solvent extraction, rotogravure printing and smokeless powder.

Solvent recovery by means of activated carbon can be used to recover almost all commonly used industrial solvents such as hydrocarbons, alco-

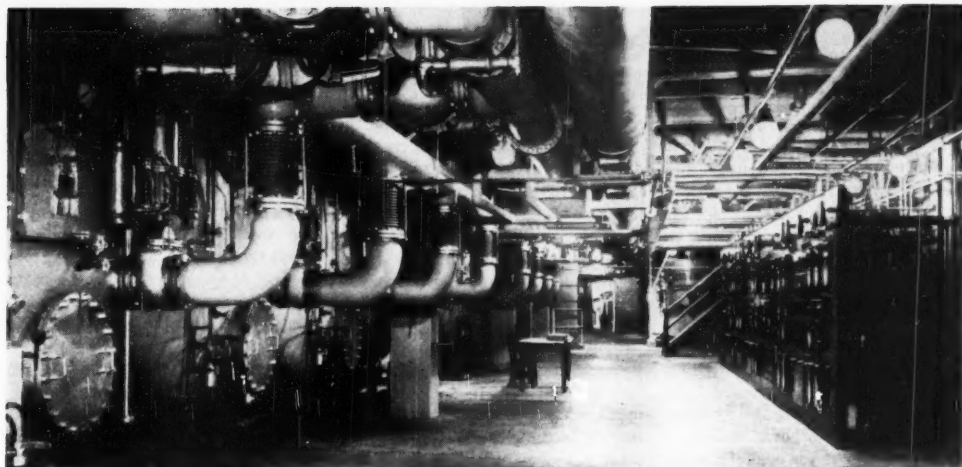
hols, esters, ethers, ketones and chlorinated compounds. The overall recovery efficiency is usually between 80 and 95 percent, depending almost entirely upon the effectiveness of the vapor collection system. Well designed hoods over the manufacturing process should give an overall recovery efficiency of over 90 percent.

Solvent recovery by activated carbon as now practiced is a batch process. The vapor-laden air is passed through a bed of activated carbon which adsorbs the solvent and allows the stripped air to pass through. Two or more vessels containing activated carbon, commonly called adsorbers, are usually used to give continuous operation of the process. When one adsorber has become charged with solvent, the flow of vapor-laden air is then switched to another adsorber. Solvent is then removed from the charged adsorber by passing saturated steam through the activated carbon counter-current to the direction of air

flow. The mixture of steam and solvent vapors from the adsorber are condensed and then passed to separation equipment.

The adsorbers are usually horizontal cylindrical pressure vessels with a horizontal bed of activated carbon located at the center. The size of each adsorber and the amount of activated carbon depends on the volume of vapor-laden air to be handled, the concentration of solvent, the adsorptive capacity of the activated carbon for the solvent to be recovered and the length of the adsorbing period used. Superficial air velocities of 50 to 100 fpm. and carbon bed depths of 12 to 36 in. are most frequently used.

The number of adsorbers depends on the volume of vapor-laden air and the concentration of solvent. For high solvent concentrations, two adsorbers are used, with one adsorber handling vapor-laden air and the other adsorber steaming to remove the ad-



Operating gallery of a multiple-adsorber solvent recovery installation, with adsorbers at left and controls at right.

sorbed solvent. For low solvent concentrations, three or more adsorbers are used.

Vapor-laden air is passed through all adsorbers in parallel except the adsorber being steamed. All adsorbers are then steamed in rotation.

Series operation of adsorbers is sometimes used in larger plants to obtain maximum recovery efficiency. Here, the usual plant consists of four adsorbers, one being steamed, two handling vapor-laden air and the fourth adsorber handling exhaust air from the adsorber longest in service on vapor-laden air. This arrangement permits operation at a maximum adsorptive capacity since any solvent passing through the almost fully charged adsorber will be picked up by the other adsorber operating in series with it.

In actual operation it has been found advantageous to continue the adsorption cycle until some predetermined solvent concentration is reached in the air passed to the second adsorber in series. This results in an almost uniform solvent charge in each adsorber and a minimum steam consumption for regeneration. This series operation usually gives a recovery efficiency of 99.7 to 99.8 percent of the solvent in the vapor-laden air delivered to the recovery plant. Recovery efficiencies of 99 percent or higher are usually obtained for plants not using series operation of the adsorbers.

Although the adsorbers are the

most essential part of a solvent recovery plant, other items of equipment must be properly selected and designed, to give an efficient and economical plant. Usually the vapor-laden air must be filtered at the inlet to the recovery plant to remove dust, lint or other solid particles carried over from the manufacturing process. This is accomplished by means of fine mesh screens or replaceable glass or steel wool filter units.

Sometimes the vapor-laden air contains materials which would contaminate the activated carbon or cause corrosion of the equipment and it is necessary to remove these by scrubbing with water or a suitable chemical solution. Packed or spray type scrubbers have been used successfully.

Since the vapor-laden air is heated in most manufacturing processes to effectively vaporize the solvent, the air must be cooled before passing to the adsorbers. Standard extended surface type coolers are used with the air outside of the tubes and the cooling water inside the tubes. A vapor-laden air temperature of approximately 100 deg. F. gives the most efficient operation unless the vapor-laden air contains an unusual moisture content.

During each steaming cycle moisture is added to the carbon by the condensation of steam to heat up the carbon bed and vaporize the solvent. This moisture must be removed during the subsequent adsorbing cycle by vaporization into the air to prevent an accumulation detrimental to re-

covery efficiency. The vaporization of this moisture from the carbon dissipates the heat of adsorption of the solvent and gives a more uniform carbon bed temperature. Where the activated carbon used has a high selective adsorption capacity for solvent in the presence of moisture, high recovery efficiencies are obtained by this method of operation. Activated carbons which do not have this selectivity require drying between the steaming and adsorbing periods, making the heat of adsorption an important factor in the design of the plant.

Vapor-laden air is usually drawn from the manufacturing process and passed through the recovery equipment by means of centrifugal blowers or fans. These are motor driven, or, if high pressure steam is available, can be turbine driven. Where turbine driven blowers are used, the turbines are designed to operate at a sufficiently high back pressure to permit use of the exhaust steam for steaming the adsorbers and operating any necessary distillation equipment for solvent separation.

Steam and solvent vapors discharged from the adsorbers are condensed and cooled in shell and tube type heat exchangers, usually horizontal. The condensate flows to the separation or distillation equipment. Water insoluble solvents can be merely decanted from the condensed steam in a continuous decanter. Water soluble solvents are distilled

from the condensate in continuous distillation columns. Mixtures of water soluble and insoluble solvents may require the use of a continuous decanter, a continuous distillation column and a batch distillation column. The design of the distillation equipment is dependent upon the degree of separation required to make the recovered solvent suitable for re-use.

Almost all solvents are flammable and form explosive mixtures with air. Special precautions must be taken in the design of the recovery plant to assure the handling of sufficient air to maintain a solvent concentration well below the lower explosive limit at the maximum possible solvent vaporization rate. This requires a careful analysis of the manufacturing process and all factors affecting the rate of solvent evaporation. Continuous combustible gas analyzers are available and can be used to sound an alarm or shut down the manufacturing process should the solvent concentration rise above some predetermined value. Spark-resistant blowers are used and all electrical equipment is usually explosion-proof. Flammability of the solvents to be recovered should be considered in the selection of all equipment for the recovery plant.

Selection of the proper materials of construction for the recovery plant is an important decision for the design engineer. Many solvents are in themselves corrosive or form corrosive products during the steaming period. Activated carbon acts as a mild catalyst in the hydrolysis or decomposition of solvents in the presence of steam. Therefore, any corrosion tests used as a basis for the selection of the materials of construction should be made in the presence of activated carbon. Hydrocarbons can usually be recovered in plain steel equipment. Other solvents require the use of copper, Everdur, Monel or stainless steels, depending on the severity and type of corrosion.

A majority of the recovery plants now installed in this country are automatically operated. All adsorber valves are pneumatically or hydraulically operated by means of a multi-cam cycle controller. This instrument controls the length of the adsorbing and steaming periods, opening and closing valves in the proper sequence. Plants are

operated with a fixed cycle or with a cycle length which is varied in accordance with the solvent loading.

Temperature of the vapor-laden air is automatically controlled by regulation of the water flow through the air cooler. Flow of the vapor-laden air to the recovery plant is controlled by a suitable orifice or pitot tube type flowmeter. This instrument positions variable pitch vanes in the inlet to motor driven blowers. When turbine driven blowers are used, the air flowmeter controls the speed of the turbine. Flow of steam to the adsorbers during the steaming cycle and the temperature of the condensed steam and solvent mixture are controlled by suitable instruments. Any necessary solvent separation or continuous distillation equipment is also automatically controlled. Automatic operation results in maximum recovery efficiency with minimum utility and labor costs.

GAS SEPARATION

Many industrial gas mixtures can be separated by utilizing the selective adsorption of activated carbon. As a rule, the higher the boiling point or the larger the molecular weight, the more strongly an organic compound is adsorbed by activated carbon. Thus gasoline, propane and butane can be separated from natural gas or methane from hydrogen.

Shortly after World War I, a number of plants were installed in this country to recover gasoline from natural gas by means of activated carbon. However, this process is no longer industrially important and has been replaced by condensation and oil scrubbing systems. The method of operation and equipment for these plants were almost identical to the solvent recovery system described previously. Contamination of the activated carbon and corrosion of the equipment by sulphur compounds in the natural gas were the major reasons for discontinuing this process.

A new process for the separation of hydrocarbons by use of activated carbon has recently been developed by the Union Oil Co. This process, called hypersorption, employs a moving bed of activated carbon. The feed gas enters the center of a tall vertical vessel having a downwardly moving bed of activated carbon. The carbon adsorbs the heavier constituents, carrying them down the tower, permitting

the lighter constituents to pass up the tower. In the lower section of the tower, the carbon is heated to drive off the adsorbed materials. The regenerated carbon is taken out of the bottom of the tower and fed back into the top. It is cooled and brought into equilibrium with the lighter constituents of the feed gas before passing down into the contacting section of the tower. Proper separation of the tower into sections and control of operating temperatures in each section results in excellent separation of the feed gas. Impurities present in the feed gas which tend to contaminate the carbon may be effectively removed by continually withdrawing a small portion of the carbon stream and reactivating at an elevated temperature. This process has been placed in operation on a number of separation problems and should have wide application in gas separation.

GAS PURIFICATION

Purification of gases by adsorption of the impurities on activated carbon can be divided into two distinct classifications. First is the removal of impurities from industrial gases such as hydrogen, carbon dioxide, ammonia, hydrogen chloride, compressed air and inert gas. Second is the removal of odors and other impurities from air in air conditioning or ventilating systems.

Purification of industrial gases is usually accomplished at elevated pressures using thick activated carbon beds three to eight feet deep in vertical adsorbers. Two or more adsorbers are used to give a continuous flow of the purified gas. Superheated steam is usually used to expel the adsorbed impurities and regenerate the carbon. Saturated steam may be satisfactory for low boiling impurities while superheated steam is usually required to remove high boiling impurities. The operation of such equipment is similar to that used for solvent recovery. After an adsorber has adsorbed a charge of the impurity in the raw gas, the gas stream is switched to another adsorber. The charged adsorber is then regenerated by steaming. Following the steaming cycle, the adsorber is usually dried or cooled before handling raw gas again.

Purification of air in air conditioning or ventilating systems is accomplished at atmospheric pressure using thin activated carbon beds one half

inch to four inches deep. The carbon is usually placed in containers or on trays to permit easy removal for regeneration. In such a system, the carbon may remain in service for several months to several years. The carbon is periodically removed and regenerated at an elevated temperature by superheated steam.

GAS DEHYDRATION

Many processes involve the use of dehydrated air or industrial gases. One of the most frequent applications is the use of compressed air with a low dew point for instrumentation or pneumatic operation systems. Other indus-

trial gases must be dehydrated where the presence of moisture would be detrimental to a process.

Usual industrial dehydration adsorbents are silica gel, activated alumina, and activated bauxite. The adsorbent is usually placed in a vertical vessel and a bed depth of two to five feet is used. Two vessels are used to give a continuous flow of dehydrated gas. After the adsorbent in one vessel no longer gives the desired degree of moisture removal, the adsorbed water is removed by heating. The heat may be applied by externally heating a portion of the inlet gas and passing it through the adsorbent. In small

units the heat is usually applied by means of a steam jacket or steam coils imbedded in the adsorbent. Following regeneration, the adsorbent is cooled by a portion of the dehydrated gas before placing back in service.

Such dehydration installations are usually operated either semi-automatically or entirely automatically. In the semi-automatic units, the operator positions one transfer lever to change the vessel on the line. Suitable interlocks then automatically perform the regeneration and cooling cycles. In the automatic unit, the entire operation is operated on a fixed time cycle without the attention of an operator.

ADSORPTION:

Fixed Bed Design More Empirical Than Moving Bed

Certain basic data are required regardless of whether the design is for a fixed or moving-bed unit. Design of moving bed units is considerably more involved.

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As some early stage in the design of an adsorption unit, decision must be reached as to whether the unit will contain a fixed or moving bed. Fixed bed adsorption is a relatively old and much practiced operation. Moving bed, continuous adsorption, the commercial example of which is the hy-persorption process of the Union Oil Co. of California, is a more recent development. The choice of techniques is a matter of economics and may in some cases be far from clear cut. In general, fixed bed adsorption is favored where carbon has a high selectivity for the constituent to be removed or where its concentration is relatively low—usually less than 2 percent by volume. Hypersorption will prove attractive where selectivity is lower, thus requiring multi-stage separation, and where the economics warrant relatively elaborate equipment.

This article is primarily concerned with design of units for adsorption from a gas stream. In the case of adsorption from a liquid stream, methods of design for a fixed bed unit are essentially the same as for a gas stream.

BASIC DATA REQUIRED

The designer of either a fixed or moving bed unit must have available

certain basic data. Equilibrium data for the constituents of the stream over the adsorbent are required, both as to total quantity adsorbed under the given conditions of temperature and pressure and the relative volatilities of the various constituents. Heat of adsorption data are also necessary. These and equilibrium data can be obtained for many systems in the literature. The papers presented at the adsorption symposium of the American Chemical Society are an excellent source of data for low boiling hydrocarbons and gases of the low molecular weight.¹

A means of predicting pressure drop through the bed is also required. The general equation for pressure drop through a bed of solids is:²

$$\frac{\Delta P}{L} g_c = K \frac{(1 - \epsilon)^2}{\epsilon^3} \frac{\mu U_m}{D_p^2} + K^1 \frac{1 - \epsilon}{1 - \epsilon^3} \frac{G U_m}{D_p} \quad (1)$$

The first term represents viscous losses while the second takes into account kinetic losses. For a given bed the particle characteristics will be constant and the equation becomes:

$$\Delta P/L = k \mu U_m + k^1 \rho_m U_m^2 \quad (2)$$

Experimental data on the given bed with one fluid will allow calcula-

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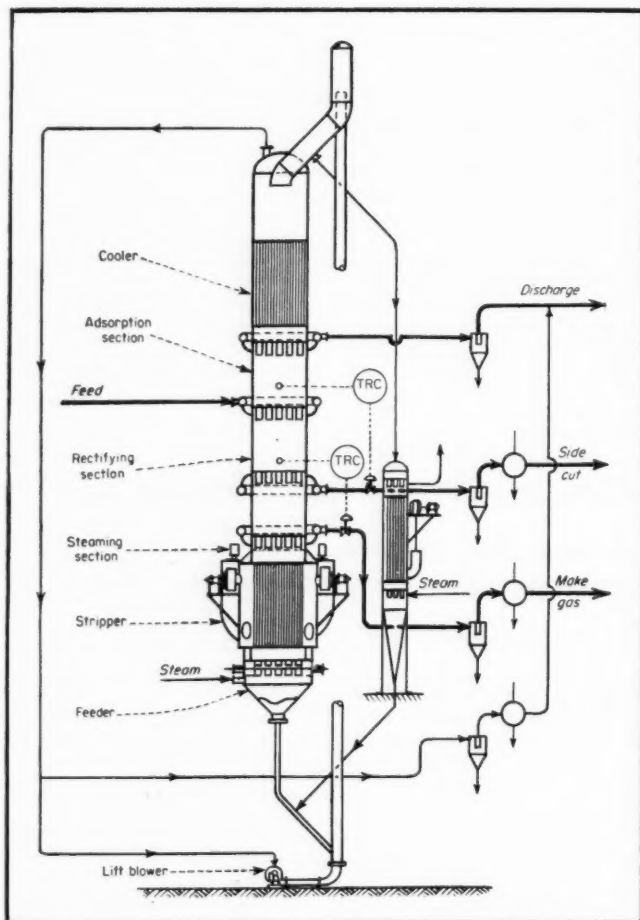
- ΔP = Pressure drop
- L = Height of bed
- g_c = Gravitational constant
- K, K^1, k, k^1 = Constants
- ϵ = Fractional void volume
- μ = Viscosity of fluid
- U_m = Superficial fluid velocity based on an empty vessel and average pressure
- D_p = Effective diameter of particle
- G = Mass flow rate of fluid = $\rho_m U_m$
- ρ_m = Mean density
- S = Plant solvent handling capacity, lb./hr.
- N_s = Number of adsorbers to be steamed at one time (usually $N_s = 1$)
- N_t = Total number of adsorbers
- W = Adsorbent per vessel, lb.
- X_a = Average adsorptive capacity, lb. solvent per lb. adsorbent
- t = Time between start of succeeding steaming period, hr.
- V_t = Plant gas handling capacity, cfm.
- V_a = Gas capacity per adsorber, cfm.

tion of pressure drop from any fluid being considered.

Lastly, the height of a transfer unit (contact stage) is required. Data is given for silica gel.³ For carbon, experimental data must be obtained.

DESIGN OF FIXED BED UNIT

A fixed bed adsorption unit will usually consist of two or more vessels



Hypersorber. Adsorbent is bed of carbon which flows downward from top of the unit.

where continuous flow of a vapor laden stream is to be handled. (See cut, p. 158). One vessel adsorbs the constituent whose recovery is desired while the adsorbent in the other vessel is having the adsorbed vapor stripped whether by steam or some other hot gas. Auxiliary equipment may include a filter to remove atmospheric dust or lint from the gas, a blower to provide the means of forcing the gas through the bed, an exchanger or spray tower to condense the solvent and steam used as the carrying agent, and a settling drum to separate the condensed solvent and water. Water-soluble solvents are of course separated from condensed apparatus. This scheme can be modified

with two or more adsorbers in series to obtain higher recoveries. Only one adsorber is steamed at a time while the leanest gas cools the adsorber which has just been steamed.

As a rule, a fixed bed adsorber will not be used for recovery purposes when a solvent laden stream contains less than 0.2 lb. solvent per mscf. of gas. High efficiency removal of undesirable constituents from a gas can be obtained by adsorption with much lower initial concentrations, however. The bed height will run from 15 to 30 in. in solvent recovery with the diameter being determined by the quantity and concentration of the carrier stream. Recoveries can be in the order of 98 percent plus.

In designing a fixed bed adsorber

the first step is the adsorption calculations. This will serve to set up the quantity of adsorbent necessary and the time a given adsorber may be on stream to give a set recovery.⁸

The following cases are treated: (1) Isothermal adsorption with a linear equilibrium relationship between concentration in the gas phase and concentration in the adsorbed phase, (2) Isothermal adsorption with complex equilibrium relationships, (3) Non-isothermal adsorption with complex equilibria.

The method for the last two cases, which are the ones primarily applicable to adsorption on charcoal as equilibria here is seldom linear, involves double stepwise integration of equations by graphical means to obtain results in number of transfer units required. Height of a transfer unit in the case of carbon must be determined experimentally. Knowing the height and number of transfer units, the required bed depth is defined.

Required time for steam or other types of stripping must also be determined. Open steam stripping is the most effective as the steam condenses in the pore displacing the solvent. It also supplies the necessary heat of desorption.

Pressure drop for a given height of bed and quantity of fluid is calculated in the case of a fixed bed unit by an equation of the form of Eq. 2. Here flow is usually turbulent. The designer must balance the cost of additional height with resulting increase in pressure drop and power consumption against the desirable effect of additional height on recovery.

In actual practice the adsorptive capacity, height of bed, and stripping conditions for a given adsorption problem are obtained experimentally in simple laboratory setups if the designer hasn't applicable know-how available. He still must calculate the pressure drop and set up an operating cycle for the plant by means of the following relations:

$$S = N_s X_s W/t \quad (3)$$

$$V_t = V_s (N_t - N_s) \quad (4)$$

It is also necessary to set up the apparatus with sufficient height and a gas distributor to avoid channelling.

MOVING BED UNIT

Stripped to bare essentials, the hypsorption process involves the intro-

duction of feed gas via a feed introduction tray into a moving bed of carbon which is designed to adsorb the heavier components of the mixture. The engaging tray, as well as disengaging trays, consist of downcomers for solid flow with the gas entering or leaving in the area around the downcomers. Below the feed section any adsorbed lighter components are driven off by a countercurrent reflux of the heavier components. Moving further downward, steam is then introduced through a tray and serves to remove the heavier components from the carbon which are disengaged at the bottom product tray. Carbon then goes through the stripping section, a vertical tube bundle, heated by condensing Dowtherm. Steam and residual heavier components are desorbed here, going out with the bottoms product.

Hot carbon leaving the stripper goes through a specially designed feeder tray which provides positive control of the carbon flow pattern and rate. Carbon then flows into the gas lift system where it is transported to the top of the tower. At the top, a portion of the overhead gas, the elutriation gas, strips any remaining steam off the carbon. Carbon then flows through the cooler section which consists of a vertical tube bundle cooled externally by water. Here the heat of adsorption and sensible heat due to stripping are removed and the carbon resumes its cycle. Hypersorbers have been fully described in the literature⁶ both as to the details mentioned above and variations in the basic scheme.

In the design of the hypersorber, besides the required data previously mentioned here, data on solid flow characteristics are required. A hypersorber is a device for transferring solids and the characteristics of solid flow are of fundamental importance in the design and operation of the unit.

DESIGN OF MOVING BED UNIT

Design of a moving bed unit is considerably more involved than that for a fixed bed unit due to the greater complexity of a hypersorber. In a hypersorber, however, composition and other conditions do not vary with time at a particular point in the column, whereas in a fixed bed unit, unsteady state transfer exists.

In designing a moving bed adsorp-

tion unit, the primary calculation is one which sets up the carbon circulation and the various bed heights involved. Methods have been developed for calculating mass transfer in a moving bed adsorber assuming: (1) Isothermal conditions and equilibrium between the adsorbed solute and the fluid present in the void volume of the solids, and (2) Isothermal conditions and non-equilibrium.⁶ In most applications, due to the heat of adsorption involved, the temperature rise in the adsorption section will be in the order of 100 deg. F. It is, therefore, not possible to assume isothermal conditions, and a stepwise calculation must be made, as the relative volatilities of various constituents over carbon change quite radically with temperature. When setting up the design, a relatively high bed height for each section is used so that carbon circulation approaches that at minimum reflux. This is due to the relatively greater expense both from a fixed cost and operating standpoint of increasing carbon circulation rather than bed height.

Heat balances for the cooler and stripper must also be calculated. They will allow the calculation of the area required for each unit, knowing the overall heat transfer coefficient and the water and Dowtherm circulation required for the cooler and stripper, respectively.

Pressure drop phenomena through a bed of moving solids is different than that involved in a fixed bed unit in that with higher velocities, the countercurrent flowing gas will tend to hold up the moving solid. The critical velocity at which this occurs must be experimentally determined because in the design of the unit, it cannot be exceeded. The pressure drop in countercurrent gas-solid flow at low velocities fits the following equation:

$$\Delta P/L = K \mu U_m \quad (5)$$

That is, pressure drop is primarily a viscous phenomena. As the velocity increases, the bed begins to expand and the increment in pressure drop falls off until finally at the point of incipient holdup of solids the pressure drop is constant and equal to that value for a unit height corresponding to the weight of a unit volume of solid. A pressure drop calculation over the entire tower must be made which will give pressure conditions throughout the tower. Calcula-

tions involving disengaging and engaging velocities of the gas must also be made at the various trays. These velocities will determine the diameter of the tower.

Solids differ from fluids in their flow characteristics and data on solids flow must be available to the designer. The angles of internal and external repose whose tangents are the respective coefficients of friction define the solids flow pattern. The amount of solid that can flow through a given orifice must also be known as must the effect of pressure differential across the orifice on the solid flow. The force the solid exerts on the various trays is required to allow proper mechanical design.

Velocities required to lift the carbon in the lift line as well as the optimum lift line velocities from the standpoint of minimizing attrition must be known by the designer. Knowing these and the quantity of carbon to be circulated, he can calculate the quantity of lift gas required and having the pressure drop involved in the lift line system, the lift line blower can be specified.

Fine particles are elutriated from the carbon by the elutriation gas in the elutriation section at the top of the column. It is necessary to determine the number of elutriators required for the given carbon circulation. The circulation rate sets the amount of attrition and the rate at which fines are produced.

In the case of a gas which has constituents which polymerize on the carbon forming heavy constituents which cannot be removed in the hypersorber, it is necessary to remove these polymers by reactivation. C_4 and heavier double-bonded unsaturates, such as butadiene and pentadiene are examples of substances that cause deactivation.

Reactivation is accomplished via a water gas reaction at temperatures in the order of 1,450 deg. F. If reactivation is required, it is necessary to calculate the reactivation load and the amount of heat required.

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Theory and Practice Are Converging

Flow of information of a theoretical and experimental nature is constantly improving our understanding of the fundamental concepts.

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Adsorption is one of those unit operations in which the science has not yet caught up with the art. Yet the science of this subject is developing fast, and it is likely that current practices will soon be vastly improved as a direct result of contributions from researchers exploring the fundamental concepts.

Already there is excellent qualitative agreement between theory and practice, but firm quantitative agreement is yet to come.

MATERIAL BALANCE

A consideration of material balance will help explain the mechanism of columnar adsorption, as far as it has been determined to date.

Let us take a thin cross-section of a column packed uniformly with adsorbent and a fluid consisting of a carrier and a second (adsorbable) component flowing downward at a constant rate (Fig. 1).

For any such section the adsorbate coming in equals the adsorbate leaving plus the accumulated adsorbate.

There are two independent variables involved in this flow, namely distance and time. Therefore Eq. 1 uses partial derivatives with one of the independent variables held constant in each term. The sum of the various rates of change of the adsorbate is set equal to zero.

The first term in Eq. 1 reflects the change in amount of adsorbate caused by fluid flow. The mere fact the fluid is moving means that more adsorbate is being supplied to the section.

The second term reflects the fact that the amount of adsorbate actually adsorbed increases with time.

The third term reflects the fact that adsorbate in the pore of the packed bed is building up with time. After adsorption takes place initially on the surface of an adsorbent, the adsorbate works its way into the pores of the adsorbent.

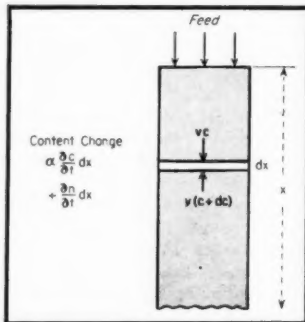


Fig. 1—Thin cross-section.

In deriving Eq. 1 a number of assumptions are made. It is assumed that both the fluid velocity and the solute concentration profiles are uniform across any cross-section of the bed.

However, it has been shown that the fluid flow patterns in a packed bed are extremely complex and in many cases deviate widely from the uniformity required by the material balance.^{4,5} The concentration of adsorbate leaving the bottom of an inert bed when plotted versus the volume of solution collected has been shown to resemble an S-shaped curve.⁶ These complex flow patterns are intimately related to the wall effects, lateral mass transfer⁴ and the random-walk type flow pattern existing in a packed bed; their magnitude and importance being a function of the column and particle dimensions as well as the packing arrangement employed.

Work is under way⁷ at the present time which may be of assistance in explaining certain aspects of the flow pattern.

Longitudinal diffusion effects have been considered as negligible in Eq. 1. However, for the case of very slow fluid flow these effects may become important. In this case, we equate the first three terms to the amount

of adsorbate transported across the thin film by diffusion.

The adsorption process is considered to be isothermal which for most liquid systems and many gaseous systems is substantially valid. In the case of physical adsorption at not too high concentrations, temperature changes may be neglected. However, for activated adsorption which frequently is highly exothermic, thermal effects may be of primary importance. Pressure drop across the length of the packed column is also considered negligible.

Various other assumptions in the material balance such as negligible attrition of the adsorbent particles, negligible change in total mass flow rate and a constant pore volume are generally correct for the majority of experimental systems. One possible important exception to the concept of a constant pore volume is found in ion-exchange systems where changes in void volume as great as 2 to 1 may occur.

Any attempt to include these various complicating factors into the material balance leads to such complexities that an exact mathematical solution becomes highly improbable. It is thus evident that the material balance represents an idealized process and that further work, both theoretical and experimental, is required before it can be used with complete confidence.

TRANSPORT AND ADSORPTION RATES

To the material balance must be added an equation which indicates the rate at which adsorbate molecules are transferred from the bulk of the flowing stream to the adsorbent surface followed by adsorption on the surface.

There are quite a number of individual resistances or steps which retard the rate of transport or adsorption and the magnitude of these resist-

ances may be such that they each contribute to the over-all rate. We shall now discuss each of these steps in turn corresponding physically to the situation where each is the rate-determining process. You will note the mathematical similarity between each of the rate equations presented.

The first case to be considered is one in which the rate-determining step is the transport of material across a hypothetical thin fluid film surrounding each particle. This retardation, completely analogous to the various heat and mass transfer problems encountered by the chemical engineer, can be expressed by Eq. 2.

The mass transfer coefficient is determined by the molecular diffusivities of the solute involved for laminar flow and the eddy diffusivity for turbulent flow and can be computed by standard methods. This rate equation has been applied to a number of liquid systems and there seems little doubt that it is a good approximation in describing many observed rates of adsorption.

With regard to gaseous adsorption a possible distinction can sometimes be made between the type of adsorption involved. Two types are possible, physical or Van der Waals and activated or chemisorption. The first is characterized by an almost instantaneous approach to equilibrium, low activation energies and reversibility of adsorption. In contrast chemisorption exhibits a definite rate of approach to equilibrium, high activation energies and almost an irreversibility of adsorption. The bond forces involved are of the same nature as cause the deviation of real gases from the laws of ideal gases and that cause cohesion in liquids and solids. In systems involving physical adsorption alone mass transfer effects through a bounding film may be quite important. A direct check of Eq. 2 on a single adsorbent particle has been made with excellent results.¹⁸ For chemisorption alone this type of diffusion may no longer be important. When both adsorption processes are occurring at the same time generalized predictions are usually of little use.

Secondly, the rate of adsorption on the surface of the adsorbent may, in the absence of any serious diffusional effects, be the rate controlling process. One way of representing this process mathematically is shown in Eq. 3.

Material Balance

$$v \frac{\partial c}{\partial x} + \frac{\partial n}{\partial t} + \alpha \frac{\partial c}{\partial t} = 0 \quad (1)$$

Rate of change of adsorbate caused by fluid flow Rate of change of adsorbate held on adsorbent particle Rate of change of adsorbate held in pore volume of packed bed

Equations for Transport and Adsorption Rates

$$\frac{\partial n}{\partial t} = k_g \times (c - c_s) \quad (2)$$

Rate of change of adsorbate on adsorbed phase Mass transfer coefficient Concentration of adsorbate in bulk solution surrounding particles minus concentration of adsorbate in equilibrium with adsorbed adsorbate

$$\frac{\partial n}{\partial t} = k_1 c - k_2 n \quad (3)$$

Rate of change of adsorbate on adsorbed phase Reaction constant times concentration of adsorbate in bulk solution around particles Reaction constant times concentration of adsorbate adsorbed on particles

$$\frac{\partial n}{\partial t} = k_s \times (n_1 - n) \quad (4)$$

Rate of change of adsorbate on adsorbed phase Solid mass transfer coefficient Adsorbate concentration on solid in equilibrium with fluid phase concentration minus concentration of adsorbate on solid

$$\frac{\partial n_s}{\partial t} = D_s \times \left(\frac{\partial^2 n_s}{\partial r^2} + \frac{c}{r} \frac{\partial n_s}{\partial r} \right) \quad (5)$$

Rate of change of adsorbate in intra-pore volume of particles Constant determined by solid diffusivity and adsorption isotherm Rate of diffusion of adsorbate into spherical particles of radius r

Note that Eq. 3 is of the same mathematical form as previously presented for liquid film diffusion differing only in the interpretation of the constants. The rate of chemical reaction is assumed to be reversible and first order in either direction. More complex and simpler rate equations have also been advanced.

Experimental studies have indicated that the rate of adsorption is usually much faster than the various diffusional rates. A possible exception may occur when a very slow activated adsorption takes place. In all other cases it can be said that a kinetic rate equation has little practical value other than as a mathematical tool.

Perhaps the most important and the most complex of the rate steps is the diffusion of solute molecules into the pores of an adsorbent particle. The formulation of a single rate equation for internal diffusion of sufficient generality is a major undertaking. Approximate rate equations have been proposed based upon the assumption that the rate of diffusion into the pores is essentially proportional to the amount of solute still required to pro-

duce equilibrium. See Eq. 4. Or, by using Fick's diffusion equation for diffusion into a sphere, we have Eq. 5.

Eq. 4 is based upon a solid diffusion film analogous to the liquid film. In at least one case⁶ the use of Eq. 4 has resulted in a fair degree of correlation with the data taken. In contrast to the liquid mass-transfer coefficient, the solid transfer coefficient must be calculated from the column runs themselves.

The problem facing the investigator is as follows: given a solution of known concentration at the surface of an adsorbent particle, what type, size and shape pores are available for diffusion and how fast will the solute diffuse into the pores? Further complications arise, in that the molecule as it diffuses into the pore spaces does

NOMENCLATURE

c = Concentration of adsorbate in fluid phase, mols/liter.

n = Concentration of adsorbate in adsorbed phase, mols/gram.

x = Mass of adsorbent from top of column, grams.

t = Time, min.

v = Flow rate of solution, liters/min.

a = Pore volume, liters/gram.

not follow a linear path but instead follows a random-walk path caused by collisions with other molecules and the pore walls. For very small pores, diameter equivalent to the mean free path of the gas molecules, collisions with the wall become predominant and the so-called Knudsen flow occurs. The effective diffusivity for this type of flow may be 1,000 times slower than the normal diffusivity and the flow itself exhibits completely different properties than normally is observed.

For larger pore openings the collisions between molecules will be the limiting factor and the effective diffusivities will be those normally present in the literature. It is important to realize that liquid diffusion coefficients are often 10^{-4} times smaller than gas diffusivities.

In contrast to these two internal diffusional processes which utilize the volume of a pore there also exists a type of surface migration called Volmer diffusion. This is an unusual type of diffusion in which the molecules are mobile and are thought to progress down the length of a narrow pore by jumping from one surface point to the next.¹⁰ It seems probable that a Volmer type diffusion combined with activated adsorption would be an extremely slow process.

For the normal porous adsorbent the low values of diffusivities which result from the various internal dif-

fusion processes makes diffusion in a porous medium much more probable as the rate-determining step than any other process. Data presented^{11,12} strongly indicate the truth of this statement. However, the experimental conditions may uniquely determine the most important transport step. A change in the rate-determining steps as the concentration of inlet solution was changed has been reported.¹³

There is one other possibility which presents itself. The flow of solution through the bed may be so slow that the rate steps are minimized. In this case molecules in the flowing stream and those on the adsorbent will be in continuous equilibrium with equilibrium being established instantaneously. This concept has been the recipient of considerable theoretical and experimental work in the field of liquid adsorption with the theoretical predictions dependent largely on the adsorption isotherm assumed. The majority of experimental data reveals that the assumption of an instantaneous equilibrium is merely an approximate one even under the most exacting conditions. Granted for the moment that equilibrium conditions can be approached, it has been shown¹⁴ that neglecting longitudinal diffusion can lead to serious errors, a fact which has not received the recognition necessary. Qualitatively there is much to be said for this approach.

To complete the mathematical system of equations the boundary values must be added to the material balance equation and each one of the rate equations. The solution of the system of equations with any boundary conditions desired can be obtained by methods already described.¹⁵ Electronic computers now in use¹⁶ will solve more complicated rate equations than has been indicated in this article.

You will note that no mention has been made concerning the case of two or more solutes adsorbed together or the case where more than one rate process is important. The problems presented by either of these cases is so formidable that no attempt to discuss them will be presented in this article.

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ADSORPTION:

Bigger Role Lies Ahead

Adsorption has come of age as a unit operation. It will continue to grow substantially by expanding into new fields and extending old ones.

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Substantial improvement both in adsorbents and in adsorption processes appears likely in the near future.

DEVELOPMENT OF ADSORBENTS

New adsorbents will arrive largely as a matter of economics, with particular emphasis on first cost and perhaps a secondary emphasis on service life, regeneration and stability in use.

Fuller's earth and clays are the adsorbents in heaviest tonnage and characterized by low cost, wide availability, good regeneration, and relative chemical inertness. Relatively minor improvements in preparatory processing without appreciable increase in cost will take place.

Silica gel and alumina are excellent desiccants but relatively expensive for

large throughput installations requiring large tonnages of adsorbent. Cost considerations have brought bauxite into the tonnage picture and could be expected to increase its importance. Improvement in chemical resistance, greater ability to withstand "poisoning" by sulfur compounds so that service life is lengthened, are developing.

Comparatively the acid-treated clays

Commercially Important Adsorbents in Order of Tonnage Consumed¹

Adsorbent	Important industrial uses	
Fuller's earth	Refining of petroleum fractions, vegetable and animal oils and fats, and waxes	Alumina and bauxite
Bauxite	Percolation treatment of petroleum fractions; dehydration of gases	Silica gel
Acid-treated clays	Contact filtration of petroleum fractions	Ion-exchange materials, base-exchange silicates, synthetic-resin exchangers
Bone char or bone black...	Sugar refining; ash removal from solutions	Medicinal carbons
Decolorizing carbons and water carbons	Decolorizing and purification of inorganic and organic substances; water purification; purification of food products; sugar refining; refining of vegetable and animal oils; of fats and waxes	Metal-adsorbent chars
Gas-adsorbent carbon	Solvent recovery; elimination of industrial odors; purification of carbon dioxide and industrial gases; gas masks; fractionation	Bentonites
		Magnesia

of hydrocarbon gases and liquids; hypersorption
Dehydration of air, gases, and liquids; chromatographic adsorption
Dehydration and purification of air and industrial gases, air conditioning; fractionation of petroleum distillates; gas masks
Water treatment, de-ashing of sugar; concentration from wastes; recovery of alkaloids, etc.
Elimination of bacteria and toxic poisons; an addition to animal foods
Recovery of precious metals
Treatment of petroleum fractions
Treatment of gasoline and regeneration of dry-cleaning solvents

are expensive, their further development will be along the line of specialty applications.

Bone char is the tonnage adsorbent of the tonnage sugar industry, and is of low cost. Synthetic competitors such as the hydroxyapatite Synthad, have been developed and subjected to plant scale tests as the result of industry-sponsored research. Replacement of bone char, if and when it occurs, will be slow because the financial margin is so small.

In the decolorizing type carbon, by far the largest tonnage is in the low cost "water carbon," made from by-product or waste material, where aggressive selling, continuous contact with customers and technical servicing is the order of the day and has been for several decades. Literally, thousands of raw materials and many cheap wastes have been used as raw materials throughout the world; few survived economic childbirth because of cost problems in collection and transportation of raw materials, processing and distribution. With increasing population and greater re-use of water, there will be greater tonnages of water carbons (perhaps mostly as byproducts of chemical recovery operations) consumed in North America for taste and odor control.

Gas adsorbent carbons are high cost materials, largely because of low weight yields in activation, but their multi-time use and specialized characteristics offset this to a degree. Originally made only from nut chars, but now also from coal, their physical characteristics cover a wide range, with a range of prices.

Iron oxide gels might be thought of as potential adsorbents; they can be made with tremendous surfaces as can other hydrous oxides. However, they are chemically active, readily con-

taminated and difficult to regenerate.

Of the ion-exchange materials, the synthetic zeolites are the low cost tonnage materials where great advances have taken place in manufacture, particularly in employment of solar energy and mechanical harvesting. In contrast the resin exchangers are expensive and to a degree fragile, but their range of application is far greater. Improvement in physical stability and capacity may be expected to develop.

Greater interest and application of adsorbents in human metabolism is evident in the use of carbons for detoxication, ion exchangers in control of salt ingestion (for patients who otherwise would be on a salt-free diet) and in animal foods.

For non-tonnage and special purposes, more varieties of tailor-made adsorbents will be made, where price is of secondary importance as in the pharmaceutical fields.

PROCESS ADVANCES

What of the future development of processing methods of adsorption?

1. *Percolation*, the common method of sugar refining, bleaching of oils by clays, where the impurities are left in the adsorbent, will improve mostly in equipment design, material handling and regeneration equipment rather than marked improvement in adsorbents.

2. *Contact filtration*, often one-time use of adsorbents, will develop more multi-time uses of specialized adsorbents on a large scale. It will go to a greater extent into fractionation of organic compounds, after decolorization. There will be greater application to inorganic materials, including salt.

3. *Fixed bed adsorption* found now in dehumidification, odor removal and solvent recovery will perhaps through wider usage cause the development of

more abrasion-resistant, harder and stronger porous forms—but the major development will be along the lines of completely instrumented, automatic, integrated units, with lower labor attendance and utility consumption.

The petroleum and natural gas industries may be expected to put more millions into dehydration of gases to eliminate the hazards of gas hydrate formation and reduce corrosion.

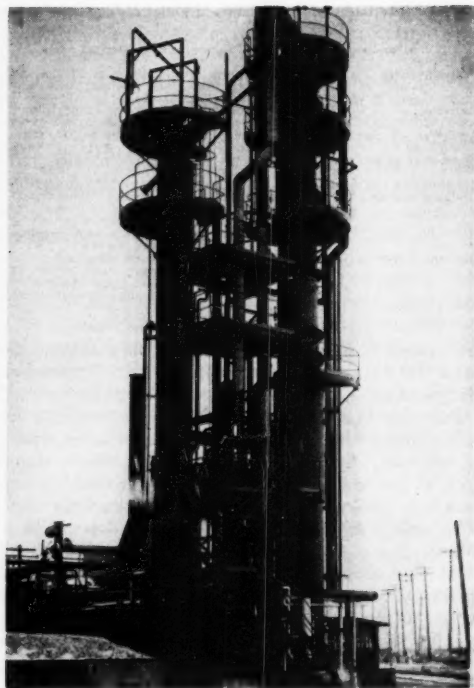
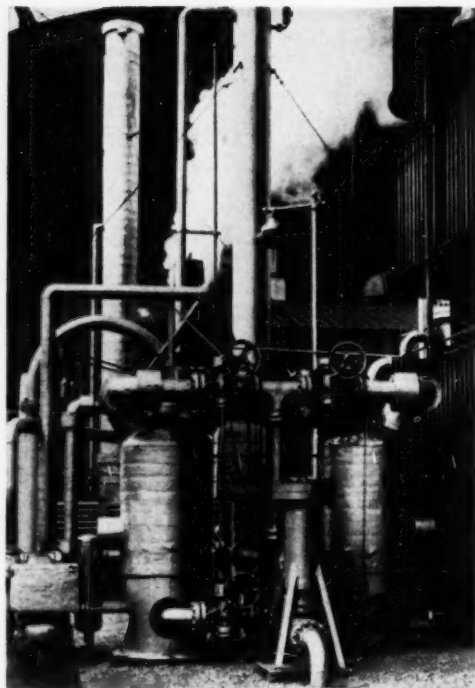
Operation Moth Ball of the Navy and the Army demonstrated that preservation of materials under controlled humidity by adsorption opened up new fields.

Air recovery, saving of refrigeration and thermal energy in large air-conditioned plants has become a growing industry.

With increasing use of tonnage oxygen, and oxygenated air, dehydration of gases for combustion will be needed for the savings in fuel and increased furnace efficiency. These however, will be mostly matters of mechanical design and the mechanical properties of the adsorbent will be more and more important.

Odor removal and air-recovery systems, as adsorptive adjuncts to air conditioning, will expand markedly from the publicized units in the United Nations building in New York, the Royal York Hotel in Toronto, the National Theatre, Washington, University of Washington, as well as many U. S. Marine and Naval hospitals.

4. *Hypersorption*, now primarily applied to ethylene recovery and methane purification, was originally developed as a light hydrocarbon recovery process from streams which could not be handled economically by other procedures. Hypersorption is adapted to large throughputs and is justified by lowered consumption of utilities (steam, water, thermal and electrical



More adsorption dehydrators such as the 600 psi. units at the left will appear. Use of hypersorbers (right) will probably be extended to include hydrogen and synthesis gas purification, acetylene recovery, and other petrochemical fractionations.

energy) over fixed bed units, as well as by lower capital costs per mcf. treated. Expected future applications are in hydrogen and synthesis gas purification, propane and butane recovery, removal of nitrogen and sulphur from natural gas, nitrogen purification, acetylene recovery, and other petrochemical fractionations including methane from hydrochloric acid and other hydrocarbons.

5. *Fractionation of liquids* in columns developed to a great extent at the National Bureau of Standards on the A.P.I. pure hydrocarbon project, is already represented by the Sun Oil Co. large-scale plant for adsorbent fractionation of aromatic hydrocarbons from petroleum fractions. Throughput in adsorption systems may be considered to be low, yet fractionation procedures of the same sharpness have the same limitation. This plant uses silica gel.

Other rather highly selective fractionations, more precise than by distillation, are under commercial development. These are often cyclic and continuous methods with emphasis on

lower utility and labor consumption per unit of purer product.

6. *Fractionation of ions*, as developed largely in connection with fission products of atom disintegration, has replaced the long tedious multi-crystallizations formerly thought to be the only method. Extension of this will be rapid probably first in the rare earth field with the major developments on specialized adsorbents and procedures and little on equipment.

7. *Ion exchange applications* grow with each newly issued publication. Demineralized water will be more and more a sine qua non for the process industries. Deionization of organic materials in multiple selective steps will in the main center around equipment design of more automatic type.

8. *Dehydration and fractionation in series* is really stepwise fractionation, but employing different type adsorbents. Perhaps the future, for operating cost reasons, will bring moving bed apparatus adapted to dehydration, where large throughput is needed.

Typical of the series setup would be an alumina dehydrator of natural or

petroleum refinery gases followed by the elimination of some undesired constituent either odoriferous or polymerizable in carbon static adsorber, with a fractionation of the constituents in a dynamic system such as that of a hypersorber.

9. *Corrosion prevention*, particularly in long, large-volume transportation systems such as natural gas lines, petroleum product lines, and gasoline distribution systems has been achieved to a large extent by dehydration of the materials transported. There will be increasing application of adsorption dehydration units in the future, employing rugged adsorbents, on the basis of the performances of units now on stream. Formation of natural gas hydrates, with freezing points above that of water (and a function of gas pressure as well) are effectively eliminated by adsorptive dehydration. Thus maintenance and repair are minimized. At the same time, corrosion is reduced.

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New Grinding Theory Aids Equipment Selection

From the work index for any material, you can extrapolate lab tests, correlate plant data, or predict performance of new size reduction equipment.

FRED C. BOND

A new theory of size reduction has been developed by the author^{1,2} to supplant the older theories of Rittinger and Kick.

F. C. BOND is Allis-Chalmers' crushing and grinding expert in the processing machinery section at Milwaukee. He's at the left in the above picture, supervising a test on a Blake crusher.

According to Rittinger's theory, the work consumed for reduction of particle size is directly proportional to the new surface produced. On the basis of stress-analysis theory for plastic deformation within the elastic limit, Kick's law states that the work required for crushing a given quantity of material is constant for the same reduction ratio, irrespective of the original size.³

According to the new third theory, the work necessary to break a ton of rock is inversely proportional to the square root of the diameter of the product particles. This theory assumes that the work input necessary to break rock is essentially that necessary to deform the rock beyond its critical strain and form crack tips; the rock splits without the application of additional energy. Most of this work is transferred into heat when the applied stress is released.

BASIC EQUATIONS

Key factor in the new theory is an expression known as the work index W_i , characteristic of any particular material. It is defined as the kwh. per short ton required to break from infinite particle size down to 80 percent passing 100 microns. It can be calculated as

$$W_i = W \sqrt{P/100} \left(\frac{\sqrt{R}}{\sqrt{R}-1} \right) \quad (1)$$

where W is the work input in kwh. per short ton, R is the reduction ratio F/P , F is the size, in microns, of the square hole through which 80 percent of the feed passes and P is the size through which 80 percent of the product passes.

Eq. (1) is used to find the work index for any crushing or grinding operation where the values of W , F and P are known. To find the work input necessary for any feed and product size when the work index is known, solve for W as follows:

$$W = W_i \sqrt{100/P} \left(\frac{\sqrt{R}-1}{\sqrt{R}} \right) \quad (2)$$

Designating size as "80 percent passes" is the most significant method of expressing a screen analysis in one term; it can be found easily from the plotted size distribution.

LABORATORY TESTS

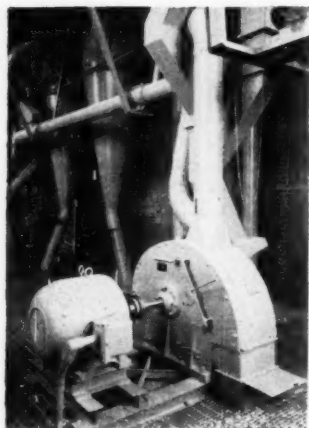
Values of the work index can be found from suitable crushing and grinding tests, such as those developed in the Allis-Chalmers processing machinery laboratory.³

For crushing, the work index is found from

$$W_i = 2.59 C/S \quad (3)$$

where C is the impact crushing strength of the rock in ft.-lb. per in. of thickness and S is specific gravity.

For grinding, the work index is calculated from



HAMMER MILL grinding grain in a Kentucky distillery.

$$W_i = 0.80 W_p \sqrt{P_s/100} \quad (4)$$

where W_p is the kwh. per net ton of material passing size P_s (in microns) in wet grinding.

For rod mills,

$$W_p = 23/G_s^{0.625} \quad (5)$$

and for ball mills,

$$W_p = 20/G_s^{0.82} \quad (6)$$

where G_s is the rod-mill grindability in net grams of undersize produced per mill revolution and G_s is the ball-mill grindability, expressed in the same units.

Methods can be developed for finding the work index from any laboratory crushing or grinding test where feed and product sizes and work input are known.

CRUSHING CALCULATIONS

The power required for a crushing installation of any capacity for any product size and reduction ratio can be calculated from the work index by Eq. (2). The work index must first be found from previous crushing experience on the material, from laboratory crushing (or grinding) tests, or from comparison with a similar material of known work index.

The value of the work index theoretically remains constant for all particle sizes, but may actually vary somewhat for different product sizes because of the presence of natural grain sizes in the material; where any differences exist it is preferable to use the work index for the size nearest that of the machine product.

If the feed is scalped by a screen or grizzly ahead of the crusher it is usually within limits of accuracy to disregard the scalping operation and consider that the crusher feed is equivalent in tonnage and size to the feed to the scalping screen. However, a method of making the scalping correction has been described.¹

Capacity of a rock crusher of given size varies only slightly with the hardness and work index of the material, although the power required is directly proportional to the work index. The capacity⁴ varies directly with apparent density, width of crushing chamber (or bottom circumference of gyratory crushers), open-side setting and length of stroke at bottom of crushing plates, speed, intermittent feed stoppages, and $1 + 0.03 (26 - \text{angle of nip in degrees})$.

A crusher of the proper size can be selected from the calculated required power input and the manufacturer's rated capacity with the above factors specified.

Hammer mills can be selected on the basis of the power input required.

The 80 percent passing size of the feed to large primary crushers is usually over-estimated, and an effort should be made to measure the actual feed size.

GRINDING CALCULATIONS

Power required for a grinding installation can be found by Eq. (2) from the work index when feed size and product size are specified, and the work index can be calculated by Eq. (1) when W , F and P are known.

Dry grinding in tumbling mills requires approximately one-third more power than wet grinding, and the power required for the fan on a dry closed-circuit mill is much more than that for the rake classifier of a wet closed-circuit mill. However, the metal wear per ton in dry grinding is only about one-fifth that of wet grinding.

Closed-circuit grinding to a specified product size requires slightly less power than open-circuit grinding, and the work index calculated from closed-circuit installations should therefore be lower.

The critical speed N_c is the rpm. at which a small particle will centrifuge against the lining of a mill. It is figured as

$$N_c = 76.63/\sqrt{D} \quad (7)$$

where D is internal diameter in ft. Mill speeds are commonly expressed as percent of critical.

Another equation for the average operating speed N_o , or optimum speed, of ball mills is

$$N_o = 57 - 40 \log D \quad (8)$$

Rod mills commonly operate at about 85 percent of the speed of a ball mill of the same internal diameter.

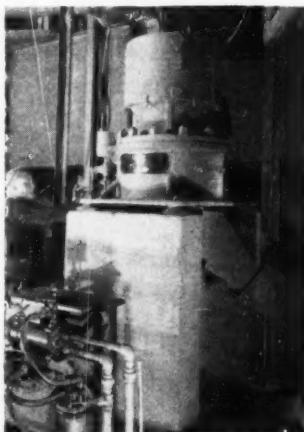
The ball charge in a ball mill contains about 40 percent of void space and weighs about 290 lb. per cu. ft.; the rod charge in a rod mill contains about 20 percent voids when the rods touch each other and weighs about 390 lb. per cu. ft. The percent V_s of the mill volume which is occupied by the grinding charge is found by measuring the vertical distance Q in ft. from the top of the mill inside liners to the top of the leveled grinding charge, and using the equation

$$V_s = 113 - 126 Q/D \quad (9)$$

This equation applies where Q is less than $3/4D$.

Power input theoretically varies as mill diameter D to the 2.5 power. In fine grinding at slow speeds the capacity is found to vary as $D^{1.2}$, but in coarse grinding at fast speeds it approaches D^3 ; thus a large-diameter mill is more efficient for coarse grinding.

Power input can be calculated from the weight of the grinding charge in tons. When the required power input for a given installation is known from the work index and feed and product sizes, the mill size which contains the



CONE CRUSHER used for secondary reduction of ferroalloys.

Table I—Typical Power Requirements for Grinding Mills

	Speed, % of N_s	Kw. per Ton of Charge
Rod mill, wet overflow	85	5.75
Ball mill, wet overflow	100	6.77
Ball mill, wet diaphragm	100	8.30
Ball mill, dry diaphragm	100	9.60
Ball mill, dry diaphragm, coarse	100	10.20
Ball mill, dry diaphragm, fine	86	7.50
	100	8.72

Table II—Typical Values for Metal Wear in Grinding Mills

	Kwh. per Lb. of Metal
Wet Grinding, balls and rods	7
mill lining	30
Dry grinding, balls and rods	35
mill lining	150
Hammer mills	5 to 10
Fine crushing	30
Coarse crushing	40

proper weight of grinding charge can be selected from the manufacturer's ratings. Some average values are listed in Table I.

Capacity and power required vary directly with mill speed throughout the usual operating range, but ball and liner wear increase at higher speeds.

Metal wear is usually reported in lb. per ton ground, but is more accurately expressed in terms of kwh. per lb. of metal. Some typical values when grinding silicious ore of average abrasiveness are listed in Table II. These values include the weight of the worn metal discarded.

COMPLICATING FACTORS

The specimen calculation below is a simplified illustration of the use of the work index in designing a hypothetical reduction plant. In an actual application the calculation is complicated by other factors which are omitted here. These factors include:

Presence of natural grain sizes and different breakage characteristics at different sizes; percent circulating load and classifier or screening efficiency in closed-circuit operations; machine speeds and sizes; oversize in feed; pulp dilution; and ball and rod sizes in grinding.

Judgment and experience are required in evaluating the effects of these factors, but the new theory permits more accurate calculations than were possible heretofore.

ILLUSTRATIVE EXAMPLE

It is desired to crush and wet grind 1,000 short tons per day of silicious rock of specific gravity 2.70 from 80 percent passing 8 in. to 80 percent passing 100 mesh.

A laboratory impact crushing test gives a value for C of 12.5 ft.-lb. per in. Using Eq. (3) to find the work index,

$$W_i = (2.59) (12.5)/2.70 = 12.0$$

A rod-mill grindability test at 14 mesh (1,190 microns) yields a value for G_r of 15.0 net grams per revolution.

From Eq. (5),

$$W_p = 23/(15)^{0.625} = 4.24$$

and from Eq. (4),

$$W_i = (0.80) (4.24) \sqrt{1,190/100} = 11.7$$

A ball-mill grindability test at 100 mesh (149 microns) yields a value for G_r of 1.80 net grams per revolution. From Eq. (6),

$$W_p = 20/(1.80)^{0.82} = 12.35$$

and from Eq. (4),

$$W_i = (0.80) (12.35) \sqrt{149/100} = 12.07$$

Primary Crushing—Assume 7 hr. operation per day, or 1,000/7=142.9 tons per hr. From laboratory crushing test, $W_i=12.0$.

Assume that primary crusher delivers 24-in. product; $P=63,500$ microns. $F=8$ in. or 203,200 microns.

$$R = 203,200/63,500 = 3.20$$

$$\sqrt{R} = 1.79$$

From Eq. (2),

$$\begin{aligned} W &= 12.0 \sqrt{100/63,500} (0.79/1.79) \\ &= 0.21 \text{ kwh. per ton} \\ &= 0.28 \text{ hp.-hr. per ton} \\ &= (0.28) (142.9) = 40.2 \text{ hp.} \end{aligned}$$

Select 20-in. gyratory crusher at 24-in. open-side setting, non-choking concaves. Use 75-hp. motor to allow for possible overloads.

Estimated metal wear=0.21/40=0.00525 lb. per ton.

Secondary Crushing—Also assume 7 hr. per day or 142.9 tons per hr., with $W_i=12.0$.

Assume that secondary crusher delivers 3-in. product; $P=19,050$ microns. F =product from primary crusher=63,500 microns.

$$R = 63,500/19,050 = 3.33$$

$$\sqrt{R} = 1.825$$

From Eq. (2),

$$\begin{aligned} W &= 12.0 \sqrt{100/19,050} (0.825/1.825) \\ &= 0.393 \text{ kwh. per ton} \\ &= 0.527 \text{ hp.-hr. per ton} \\ &= (0.527) (142.9) = 75.2 \text{ hp.} \end{aligned}$$

Select cone crusher at 3-in. close-side setting, 1-in. eccentric throw. Use 100-hp. motor to allow for possible overloads.

Estimated metal wear=0.393/30=0.0131 lb. per ton.

Rod Mill Grinding—Assume open circuit, 24 hr. per day (41.6 tons per hr.). From laboratory rod mill test, $W_i=11.7$.

Assume that rod mill delivers 14-mesh product; $P=1,190$ microns. F =product from secondary crusher=19,050 microns.

$$R = 19,050/1,190 = 16.0$$

$$\sqrt{R} = 4.0$$

From Eq. (2),

$$\begin{aligned} W &= 11.7 \sqrt{100/1,190} (3/4) \\ &= 2.545 \text{ kwh. per ton} \\ &= 3.41 \text{ hp.-hr. per ton} \\ &= (3.41) (41.6) = 141.9 \text{ hp.} \end{aligned}$$

Select 6-ft. by 10-ft. overflow rod mill at 22.6 rpm., with 43,000 lb. of rods and 150-hp. motor. (Inside diameter=5.5 ft.)

Estimated rod wear=2.545/7=0.364 lb. per ton. Estimated liner wear=2.545/30=0.085 lb. per ton.

Ball Mill Grinding—Assume closed circuit, 24 hr. per day. From laboratory ball mill test, $W_i=12.07$.

Ball mill product is the desired 100 mesh; $P=149$ microns. F =product from rod mill=1,190 microns.

$$R = 1,190/149 = 8.0$$

$$\sqrt{R} = 2.83$$

From Eq. (2),

$$\begin{aligned} W &= 12.07 \sqrt{100/149} (1.83/2.83) \\ &= 6.40 \text{ kwh. per ton} \\ &= 8.58 \text{ hp.-hr. per ton} \\ &= (8.58) (41.6) = 357 \text{ hp.} \end{aligned}$$

Select 9-ft. by 8-ft. overflow ball mill at 19.5 rpm., with 63,000 lb. of balls and 350-hp. motor. (Inside diameter=8.5 ft.)

Estimated ball wear=6.40/7=0.915 lb. per ton. Estimated liner wear=6.40/30=0.213 lb. per ton.

Check on Over-All Reduction—Average $W_i=12.0$. Total W required in four stages=9.548 kwh. per ton.

$$R = 203,200/149 = 1,364$$

$$\sqrt{R} = 37$$

From Eq. (2),

$$\begin{aligned} W &= 12.0 \sqrt{100/149} (36/37) \\ &= 9.56 \text{ kwh. per ton (check)} \end{aligned}$$

Estimated total metal wear=1.60 lb. per ton.

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Heat Transfer to Fluidized Solids

Here is an extension of the pioneer work on heat transfer to solids in dense-phase pneumatic flow. Solids studied were coal, limestone, glass sand, clay.

W. E. SCHMID, E. P. BARTKUS and T. E. CORRIGAN

In a previous article¹ West Virginia University chemical engineers reported results of a preliminary study of the heating of fluidized solids being transported through a concentric-pipe heat exchanger.

This second article presents data obtained in a continuation of this work. Additional information has been collected on heat transfer to coal and limestone fluidized in air; data have also been obtained for glass sand and clay under similar conditions.

As in the previous work, an air dryer, a fluidization column, a heat exchanger and a solids receiving drum made up the test apparatus. Dried compressed air was introduced into the bottom of the 10-in. by 20-ft. fluidization column.

At a sufficiently high pressure, a mobile solids-air mixture could be made to flow from the fluidizer through a 4-in. O.D. copper tube. A 6-ft. length of this tube was enclosed by a jacket of 2-in. iron pipe, with provisions for introducing steam and removing condensate from the jacket. Temperatures of solids-air mixtures were measured by iron-constantan thermocouples.

FLOW CHARACTERISTICS

A fundamental characteristic of this type of fluidized solids feeder is that the operator (or experimenter) can control only the rate of air flow, with no direct control over the solids-air ratio (or solids flow rate). For the particular feeder used in these tests, Fig. 1 shows how the solids-air ratios

The authors made this study while on the chemical engineering staff at West Virginia University, Morgantown. WALTER E. SCHMID is now with Merck at Elkton, Va. EDWARD P. BARTKUS works for Du Pont in Wilmington. THOMAS E. CORRIGAN has joined Vulcan Copper & Supply Co. in Cincinnati.

for the various materials varied with air velocity.

Average particle size of each of these materials was as follows:

Limestone	0.00050 in.
Coal	0.00157 in.
Glass sand	0.00820 in.
Clay	0.00018 in.

The amount of solids capable of being carried by the air thus appears to vary inversely with particle size, except for clay. The low ratios observed for clay may have been due to its high degree of agglomeration, which would yield an effective particle size several times larger than the true particle size.

Another way of plotting the data on flow characteristics is to plot superficial solids velocity vs. air velocity (Fig. 2). For limestone, coal and clay these curves pass through a maximum at air velocities of about 4,000-6,000 lb./ (hr.) (sq. ft.). Over the range studied, a similar maximum was not observed for glass sand.

Limestone and sand flowed in the fluidized state with little or no difficulty, but it was difficult to hold steady flow rates for fluidized clay over a 10-min. period. Channeling seemed to take place in the fluidized clay bed; and as a result, homogeneous fluidization was not attained. This phenomenon appeared to be due to the extremely small particle size and to the high agglomerating tendency of this particular clay.

HEAT-TRANSFER COEFFICIENTS

In the heterogeneous solids-air systems studied, the principal resistance to heat transfer was probably the air film along the tube wall. It was expected, therefore, that an increase in air velocity would decrease this resistance.

In addition, the constant impingement of solids on the air film would also tend to decrease its effective thickness and thereby further decrease the air film resistance. Therefore, it would

be expected that this resistance would also decrease with an increase in solids concentration.

Since, as shown in Fig. 1, the solids-air ratios decreased with increasing air velocities, these two effects would work in opposite directions with any change in air velocity.

The actual over-all heat-transfer coefficients measured for each system are plotted vs. air velocity in Fig. 3. With the exception of those for sand, the coefficients at first increase with air velocity, pass through a maximum and then decrease. These curves are the same general shape as those of Fig. 2, indicating that solids velocity (or concentration) exerts a measurable influence on heat-transfer coefficient.

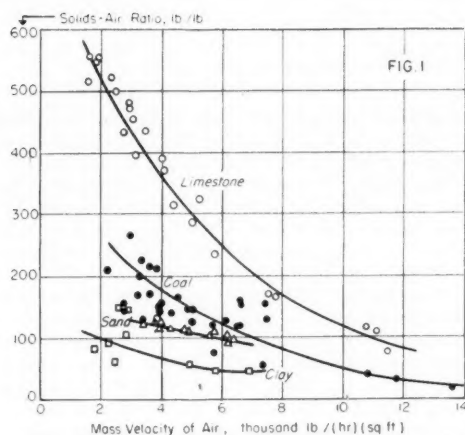
SEPARATION OF VELOCITY EFFECTS

The data have been cross-plotted in an attempt to separate the effects of air velocity and solids velocity for each case. From Figs. 2 and 3, two cross-plots can be made—one of heat-transfer coefficient vs. air velocity with constant values of solids velocity for parameters (Fig. 4); the other, coefficient vs. solids velocity with constant values of air velocity for parameters (Fig. 5). These cross-plots make it possible to evaluate heat-transfer coefficients for cases where the relationship between air and solids velocities would differ from that peculiar to the feeder used in this work.

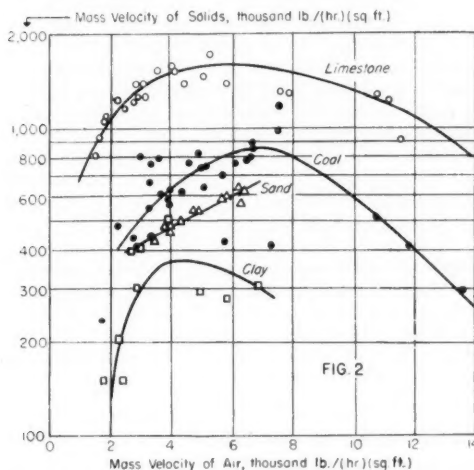
This treatment was limited to limestone and coal; the data for sand and clay were either too scattered or covered too narrow a range.

As far as is known, this work and that which preceded it are the only published articles on heat transfer to solids in dense phase fluidized flow. The only comparison which can be made, therefore, is with data for heat transfer to fluidized beds.

Mickley and Trilling² found that for fluidized beds the heat-transfer coefficient increased with an increase of



FLOW CHARACTERISTICS of experimental solids feeder.



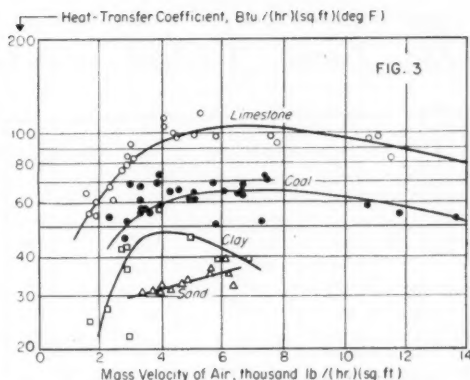
SOLIDS VELOCITY vs. air velocity for the four solids.

air velocity at low air rates. At higher air rates, the coefficient reached a maximum and then proceeded to drop off sharply with further increase of air velocity. Similar results were obtained by Levenspiel and Walton,³ Kettenring, Manderfield and Smith,⁴ and Miller and Logwinuk.⁵

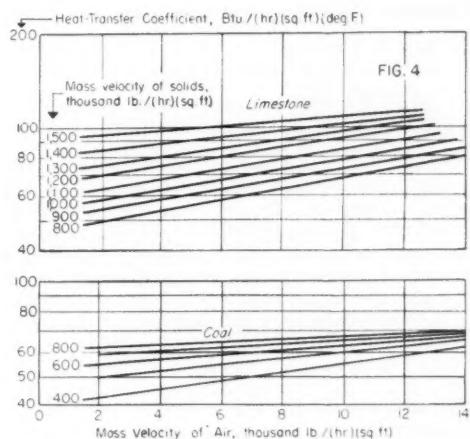
Further work is planned at West Virginia University to determine the effects of particle size and physical properties of the solids and carrier gas. Eventually it is hoped to be able to predict flow and heat-transfer characteristics for any fluidized flow system.

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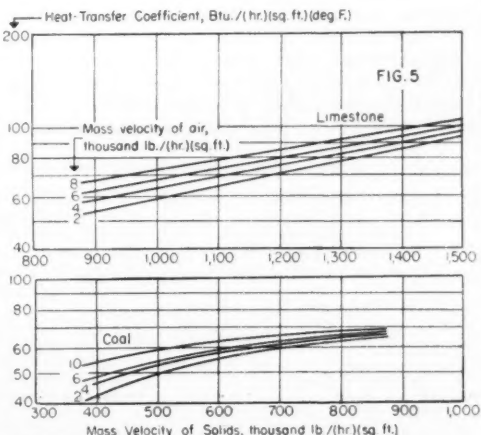
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COEFFICIENTS vs. air velocity; all experimental data.

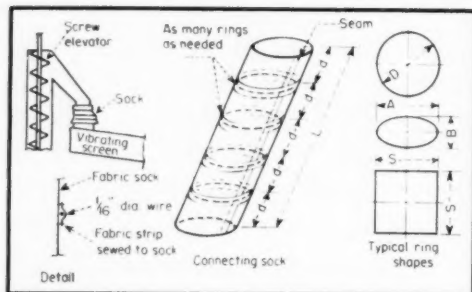


COEFFICIENTS vs. air velocity at varying solids rates.



COEFFICIENTS vs. solids velocity at varying air rates.

The Plant Notebook Edited by Theodore R. Olive



Wire-Inserted Fabric Sock Used to Connect Vibrating Equipment

STEPHEN R. NEMETH, Mechanical Engineer, Technical Section, Sabine River Works, E. I. du Pont de Nemours & Co., Orange, Tex.

★ August Contest Prize Winner

After a siege of plugging due to the collapse of connecting socks used on vibrating equipment handling solids, we developed the new non-collapsible type described here. This new type has given trouble-free service for over a year in connecting such vibrating equipment as screens and conveyors to non-vibrating equipment. It has now been adopted as standard at the Sabine River Works.

The sketch in the upper lefthand corner of the drawing indicates a typical application. The center sketch indicates the construction of a typical connecting sock, and the detail at the lower left shows how the reinforcing wire rings are attached. (Or alternately, they may be sewed directly to the sleeve, without the use of a fabric strip.) At the right a few of the possible shapes for the wire rings are suggested.

The shape of the wire rings is primarily determined by the shape of the outlet and inlet ports to which the sock is connected. Thus the rings may be any shape, i.e., elliptical, circular, square, rectangular, etc.

This type connecting sock need not be uniform in shape through its entire length. The shape could range from a square opening at one end gradually changing to a circular,

or elliptical or some other shape at its other end. The device can also be used with varying cross-sectional areas along its length to conform with outlet and inlet ports.

The distance d between the rings varies depending on the cross-sectional size of the sock. A 2-in. dimension has been found to be satisfactory for circular socks of from 6 to 10 in. in diameter, with larger spacing for larger sizes, and smaller spacing for smaller sizes.

The materials to be used in constructing the connecting socks are determined by the specific product handled. In the case of the Sabine River Works, stainless steel rings, and nylon fabric, are being used. These materials were chosen to prevent contamination of the products being handled. Other materials besides stainless steel for the rings, and nylon for the socks proper, could be used.

Connecting socks of this type can be used in any application where a flexible connecting member is required between two pieces of equipment. Our application in connecting vibratory equipment serves only as one example.

The advantages of this design over rubber or plastic tubing are: (1) This type sock is non-collapsible. (2) There is a wide variety of available fabrics that can be used, permitting a selection which will not contaminate, or be affected by the product handled. (3) There is virtually no limit to the shape of outlet and inlet ports that can be connected with this type of connecting sock and still retain the non-collapsible feature. (4) The life of this type of sock is superior to either rubber or plastic.

In arriving at the use of individual wire rings as the support for these socks, the idea of using one continuous spiral ring in place of the many individual rings was considered. We do not believe this to be as reliable as the individual rings because of probable fatigue breakage of spiral rings after extensive service. Therefore spiral reinforcement was not used.

Better Way to Recover Spilled Mercury

E. J. ERWOOD, Beta Research Laboratory, Chicago 22, Ill.

Here is an idea useful to anyone who may have occasion to pick up spilled mercury, for example, in the instrument department or in the laboratory.

★ September Contest Prize Winner

"Display Case and Data Sheets Bring Respirators Home to Plant Personnel."

A prize of \$50 in cash will be awarded to Paul C. Ziemke, safety and maintenance engineer, Oak Ridge, Tenn. Mr. Ziemke's article will be published in the November Plant Notebook section.

\$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of Chemical Engineering, will award \$50 cash each

month to the author of the best short article received that month and accepted for publication in the Plant Notebook. Each month's winner will be announced the following month and published the second following month.

\$100 ANNUAL PRIZE—At the end of each year the monthly winners will be rejudged to determine the year's best Plant Notebook article, which will then be awarded an additional \$100 prize.

HOW TO ENTER CONTEST—Any reader of Chemical Engineering, other than

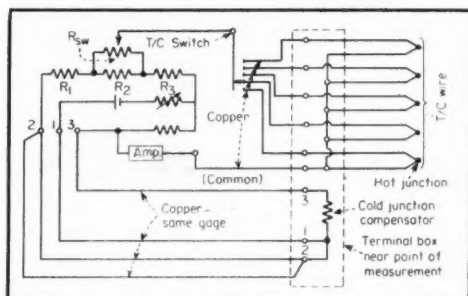
a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Articles which are acceptable but are not winners will be published at regular space rates (\$10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, Chemical Engineering, 330 West 42nd St., New York 36, N. Y.

Spilled mercury always presents a problem since any trace of the metal not recovered remains a health hazard. Usual methods of recovering the fugitive metal depend on the quantity involved. For scattered quantities the larger globules are usually cornered with stiff paper and poured into a suitable container. Smaller droplets are stabilized by sprinkling iodine crystals over the contaminated area and sweeping up the resulting mercury iodide.

These methods have obvious disadvantages. It is hard to handle mercury with paper; and iodine may corrode or stain the surface involved.

A better way consists simply in sprinkling powdered dry ice over the mercury and allowing it to freeze. The resulting mixture can be swept up easily, preferably with stiff paper. The larger pieces of frozen mercury tend to stick and must be prised loose. The method works especially well on wooden surfaces.



Move Cold Junction Compensator to Save Thermocouple Extension Wire

R. A. TERRY, Engineering Dept., Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

It is standard practice to construct industrial plants with a relatively large quantity of electrical wiring permanently installed in the structure. Steel pipe or conduit, containing copper cable, is embedded in concrete floors, walls, and supporting pillars in sufficient number to accommodate future wiring needs as well as planned requirements.

For pyrometer installations where the points of temperature measurement are remotely located with respect to the recording instrument, these installed cables can be used to connect the thermocouples to the instrument if cold junction compensation is provided at the location.

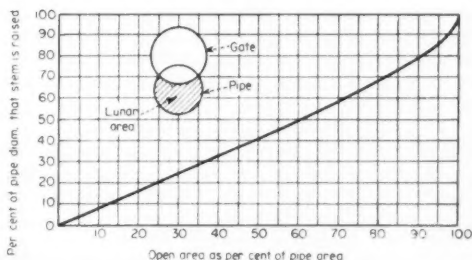
A thermocouple measures the temperature difference between its two junctions—the measuring (“hot”) junction and the reference (“cold”) junction. In order to calibrate the potentiometer directly in terms of temperature, it is necessary to include in the circuit a means of compensating for the temperature of the reference junction. A temperature sensitive resistor is used to change the balance characteristics of the measuring circuit in accordance with variations in the temperature of the reference junction. This reference junction is usually located in the compensating resistor assembly in the instrument. In that case thermocouple extension wire is used to connect the measuring junction to the instrument.

If copper wires are used to connect the thermocouple to the instrument, the reference junction will be located at the point of connection between the thermocouple and the copper wires. For temperature compensation in this circuit it is necessary that the compensating resistor be located at this point. The diagram shows a circuit suitable for such reference junction compensation.

A compensating resistor connected into the instrument measuring circuit is shown installed in a terminal box (located near the point of temperature measurement), and the compensating branch of the measuring circuit is extended to this point by means of copper cable.

Note that two wires are connected between terminals No. 2. This is an important point which may be easily overlooked. Two wires are used because the current through the slidewire branch in the potentiometer circuit is 4 ma., while the current through the other branch is 2 ma. In order that the IR drops in the external circuit may be equal, and to permit the use of a standard compensating resistor, it is necessary that the resistance in the 4-ma. branch be half that of the other branch. Since it is more convenient to use only one size wire for all connections, two wires are connected in parallel. Unless this is done a calibration error will result.

This circuit permits the use of copper leads between the thermocouples and the recording instrument. Economically, such an installation is practical only for use with multi-point instruments, because for single-point instruments, the cost of adding remote reference junction compensation approximates the cost of installing thermocouple extension wire. All thermocouples should be brought into the junction box containing the compensating resistor. For connection to the instrument, one side of each thermocouple may be common if no grounds exist in any of the thermocouple circuits.



How to Use Partially Open Gate Valves as Adjustable Orifices

WRIGHT M. FREDDER, Engineer, Dayton, Ohio.

The open area of partially open gate valves in large gas and blower air lines is very often of great value to engineers. I have found such areas valuable for: (1) Estimating the relative volume of operation among parallel gas lines feeding extraction processes, as coke-plant scrubbers, exhausters, etc.; and (2) actual metering of gas and air flows using the gate valves as variable orifices, with simple manometers connected up- and down-stream from the valve body to permit taking differential pressure readings.

The chart above shows the area of the lune that is formed when the circular gate of a gate valve juts down into the area of the pipe. I could not find formulas for determining this area in the literature, and so had to work them out, using the equations of the circle in analytical geometry to locate the intersections of the two circles. From that point on, plane geometry and a little algebra sufficed for developing the areas of the segments of the overlapping circles. The curve plots the net areas of open gate valves as percentages of the total areas of the pipe, against the percent of stem travel. The rising stem of the gate valve can be calibrated in terms of gate height, or in actual areas for the various heights.

A specific example of the use of valve areas occurred in the estimation of flows of coke oven gas through a group of four parallel sets of scrubbers. Excessive inlet pressures had indicated that stoppages in the sets had occurred due to probable accumulations of gum, naphthalene, etc. It became imperative for these scrubber sets, one at a time, to be taken out of the line and cleaned. The question was, "Which one?" Gas pressures on the inlet and outlet manifolds of the parallel sets were the same on all four sets. If we took off the cleanest one which was taking the greatest flow of gas with the least resistance, back pressures would quickly build up to hazardous operating levels. If we could get the dirtiest set off the line we might not get more than a negligible increase in pressure, or any loss of capacity in the entire group.

By means of the four similar inlet valves to the four sets of scrubbers, the dirtiest set could readily be singled out, in either of two ways.

By the first method, all four inlet gates were lowered about 40 percent of their diameters as measured on the valve stems. This left the valves about 60 percent open. From the curve this gave us an open lunar area equivalent to 70 percent of the full pipe area of each main. Drilling and tapping a hole in each side of all four gates for 1/4-in. nipples with cocks allowed us to put manometers across the relatively equal orifices of the lunar areas of the four partially open valves. The manometer that showed the lowest differential reading indicated the least flow, and thus the greatest obstruction.

Closing this set down hardly increased the back pressure and permitted cleaning. When this set was cleaned and put back into service, the inlet back pressure dropped considerably. We were then able to select the next dirtiest sets in turn and clean them at greater leisure. The valves thus became permanent orifices for use at any time for the measurement of relative flows through the parallel equipment.

This method also proved useful in the repair of worn centrifugal water pump impellers in our pump house. This house contained five similar centrifugal pumps in parallel, pumping water from the river to a common tall standpipe. It is not easy to pick out the defective pump that moves but little water, especially in the hot summer weather when water demands are highest. Taking off a good pump becomes a risky matter. By means of similar manometers (with mercury as the liquid) across partially closed valves utilized as orifices, we were able to select the pump that was doing very little work and shut it down with practically no loss in standpipe head. After all the pumps had been overhauled, we found we could carry the full water load

with four pumps, with the fifth pump held as a complete spare.

The alternate method was the trial-and-error procedure of closing the valves alternately, one at a time, down to the point where the total flow as measured by the gas back pressure (or height of water in the standpipe in case of the water pumps) became affected. The set or pump whose valve could be closed to the smallest lunar area, or closed down the most with the shortest exposed stem measurement, was the one having the least flow and doing the least good. It could most safely be taken off the line and cleaned or repaired.

Once the lunar areas of valves in various open positions are calibrated against some known metering device or calculating formula they can be used as direct flow or volume measuring devices.

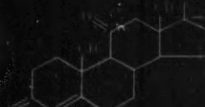


Going Up Doubles Storage Capacity

In an effort to increase his storage capacity for 100-lb. bags of raw material, a Chicago manufacturer recently switched from the use of skids to pallets. The comparison of the "before" and "after" is interesting.

With skids, handled by hand lift truck, the bags were stacked two to a layer and eight or ten layers high, making 16-20 bags per skid, as in the top view. Now he uses a 2,500-lb. capacity Mercury fork truck to handle 33 x 48-in. pallets on which the bags are stacked three to a layer and eight layers high. This makes 24 bags per pallet, but since the pallets themselves can be stacked two high, as in the bottom view, it is now possible to store from 140 to 200 percent more bags in about the same floor space.

from cortisone.....▶
to jets



There's a lot of difference between manufacturing cortisone and making synthetic lubricants for jet planes . . . but Welsbach Ozone is the key to the successful manufacture of both of them!

These aren't the only applications where Welsbach Ozone has made difficult oxidations easy . . . where it has lowered costs and increased profits. Welsbach Ozone is a new and finely-sharpened tool for industry. In widely varied uses it is proving its value and versatility as a low-cost, efficient oxidant . . . generated at the point of use—with no full time supervision or labor necessary, with operating costs constant and predictable and maintenance costs negligible.

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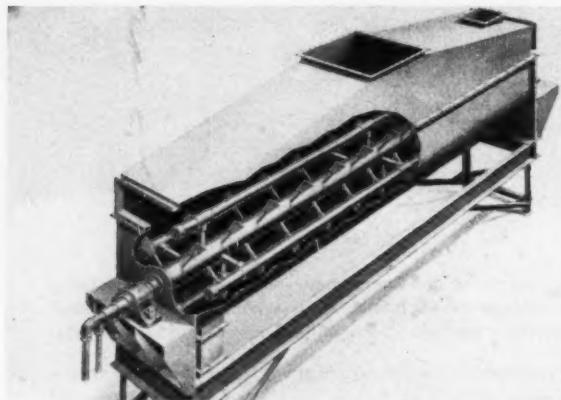
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PIONEERS IN CONTINUING OZONE RESEARCH

NEW HEATING & COOLING EQUIPMENT



Conduction Dryer Saves Fines

Drying or cooling over a wide temperature range is performed on light particles without loss of fines. Volatile byproducts and solvents are recovered.

Economical drying and cooling coupled with byproduct and solvent recovery are among the advantages claimed for the Monotube dryer. Conduction type drying practically eliminates dusting associated with readily airborne fine particles. A wide variety of pharmaceuticals, food and vegetable oil mill products, as well as many other materials, can be handled in the unit.

The Monotube dryer has only one moving part—a paddle conveyor on a hollow shaft which turns in a U-shaped trough or housing. Steam, hot liquid or coolant circulates through the shaft and outrigger tubes, producing efficient heat transfer as the material is churned and conveyed through the trough. Constant agitation assures uniform drying without overheating. There are no air currents through the material bed, thus air floating of fines is essentially non-existent.

To secure the desired heating or cooling temperature, it is merely necessary to select the proper material for circulation through the shaft and outrigger tubes. Thus, for drying below the temperature of steam, hot water

may be used while hot oil or other liquids will serve for the higher temperatures. Operating as a cooler, water, refrigerants or other cooling liquids can be circulated through the unit.

In cases where the volatile material being driven off has value, it can be recovered by passing the dryer exhaust through a suitable condenser.

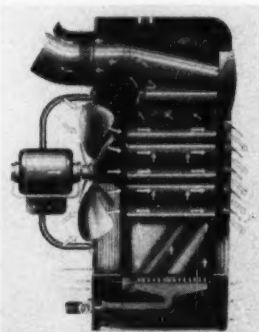
Monotube dryers are made in trough diameters of 24 in., with lengths from 5 to 10 ft., and 30 in., with lengths from 5 to 20 ft. Where highly sanitary conditions are required, the units can be fabricated of special metal such as Monel or stainless steel.

From the dimensions given and the illustration above, it can be seen that this unit provides an ideal installation where space limitations are a definite factor. Further, the simplicity of construction is said to give definite savings in first cost as compared to other types of dryers requiring complicated construction and support.

A recent Monotube installation was made by a Midwest pharmaceutical manufacturer to recover solvents formerly lost in processing. Since the

product was heat sensitive, a dryer of high efficiency with a maximum temperature limit of 140 deg. F. was needed. Corrosion resistant construction was also required. The units were fitted with condensers to recover the evaporated solvents. Solvents thus recovered paid for the cost of the unit in six months, it is said.

On another installation a chemical company cooled 250 lb. per hr. of magnesium sulphate from 210 deg. F. to 150 deg. F. using water at 70 deg. F. as a coolant.—Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.



Gas Fired Unit Heaters Have Boiler Tube Design

A new line of gas-fired unit heaters has a heat-exchanger design with horizontal steel tubes staggered to provide maximum heat-transfer service. The generously sized tubes are rolled into heavy end sheets in boiler-tube style.

The heat generator includes burner head and mixing tubes of one-piece cast-iron construction. These have been designed for efficient combustion of natural, manufactured, mixed, or liquefied petroleum gas. The complete assembly of burner, pilot and control valves is easily removed for maintenance. Built-in safety controls include a high-limit switch to prevent overheating, and automatic cut-off of both pilot light and main gas supply.

Units are sized for capacities ranging from 50,000 to 230,000 Btu. per hr. input.—The Trane Co., LaCrosse, Wis.

Equipment Cost Indexes

(Marshall & Stevens Indexes, 1926 = 100)

Industry	Sept. 1951	June 1952	Sept. 1952
Average of all	179.1	180.3	180.5

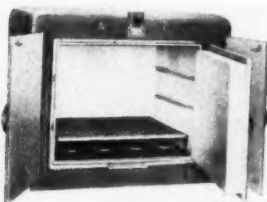
Process Industries

Cement mfg.	171.5	172.6	172.7
Chemical	179.5	181.0	181.1
Clay products	166.5	167.6	167.7
Glass mfg.	169.6	170.7	171.1
Paint mfg.	172.8	174.3	174.4
Paper mfg.	173.1	174.6	174.7
Petroleum ind.	175.9	177.4	177.8
Rubber ind.	178.3	179.8	180.2
Process ind. avg.	176.9	178.4	178.6

Related Industries

Elec. power equip.	181.1	182.6	183.0
Mining, milling	180.2	181.7	182.1
Refrigerating	198.6	200.5	200.9
Steam power	168.7	170.3	170.7

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, *Chemical Engineering*, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see *Chemical Engineering*, Feb. 1952, p. 191.



Portable Oven Gives High Temperature

This high-temperature oven is portable for use any place in a plant. Inconel sheathed, sealed tubular heating elements and thermostatic control provide operating temperatures ranging from 300 to 1,000 deg. F.

Interior surfaces are stainless steel backed by a minimum of 4 in. of fiberglass insulation.

Exterior dimensions are 30 x 25 x 24 in. while inside dimensions are 22 x 18 x 16 in. The unit operates on 220 volt, single phase power.—Crieve-Hendry Co., Inc., Chicago 22, Ill.

Humidifier Atomizes Centrifugally

The new Bahnsen Type E humidifier designed for overhead suspension utilizes centrifugal atomization, giving low-cost, automatic humidification, it is said.

An individual unit can evaporate

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up to 3 gal. of water per hr., using a ½-hp. motor, or up to 1½ gal. per hr. with a ¼-hp. motor. Moisture is discharged around a full 360-deg. circle. Automatic regulation can be provided by an electric humidistat.

To install unit, simply suspend from overhead and connect water and electricity.—Bahnsen Co., Winston-Salem, N. C.

Steam Trap Has Very Large Capacity

A new design, Type SP, of the Velan steam trap is offered where exceptionally large capacities are required. It is said that this piston-operated trap is three to ten times lighter than other designs of similar piston-operated traps. Very large air-discharge capacity is claimed.

All moving parts are made from stainless steel. A heavy duty phosphor strainer screen is used for pressures up

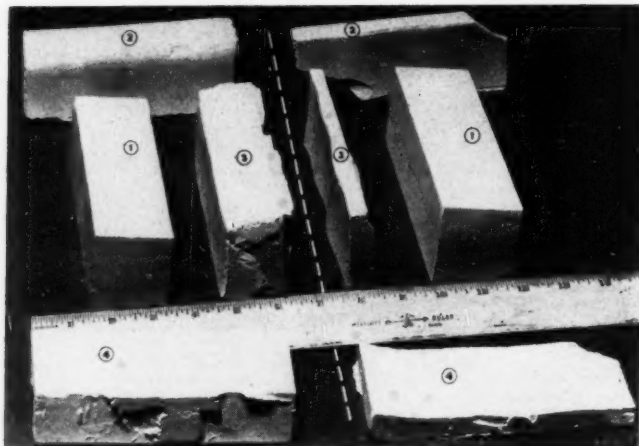
to 250 psi. At higher pressures, stainless steel screen is used. The trap is available with 1½, 2, 2½ and 3-in. screw connections or 1½ to 5-in. flanged connections.—Velan Engineering Co., 1 Exchange Place, Jersey City, N. J.

Roof Ventilator Resists Acid Corrosion

Corrosion problems associated with the venting of acid fumes are said to be largely overcome by the use of a new power type roof ventilator. This unit made of polyester resin and fiberglass gives complete resistance to the corrosive effect of acid fumes.

The unit is an outgrowth of efforts to lick ventilator corrosion over steel mill pickling operations. It is felt the unit will find other applications where acid fumes must be vented.—Iron Lung Ventilator Co., Cleveland, Ohio.

NEW PROCESSING EQUIPMENT



SUPER porcelain brick and REGULAR porcelain brick after year's test.

New Grinding Brick Wears Less

Wear of grinding balls and brick is substantially reduced when using this new material. A year's test run furnishes ample evidence on wear resistance.

Reduced ball mill maintenance is in the offing where porcelain liner brick and balls are used. A new high density grinding medium has been developed recently which shows substantially less wear reduction than regular porcelain grinding media. It is claimed that Super-Porcelain balls and brick not only do a better grinding job, but also accomplish substantial savings both in grinding time and down time.

Evidence of Super Porcelain's wear resistance is shown by recently released results of a year's test run conducted by the manufacturer. Mullite grog, a refractory compound of alumina and silica with a maximum size of $\frac{1}{4}$ in. was reduced to all through 200 mesh. Batch grinding time for this hard, tough job was said to have been cut 45 percent.

The test mill which was 42 in. in diameter by 48 in. long was operated full time for one year. Number of charges handled was 205; number of hours, 2,701; number of revolutions, 4,863,000 at 30 rpm.

Mill lining consisted of McDanel regular porcelain brick on half the interior surface and McDanel Super Porcelain brick on the remaining half.

All lining bricks were 2 in. thick. Super porcelain grinding balls 2 in. and $2\frac{1}{4}$ in. in diameter were used throughout the test run.

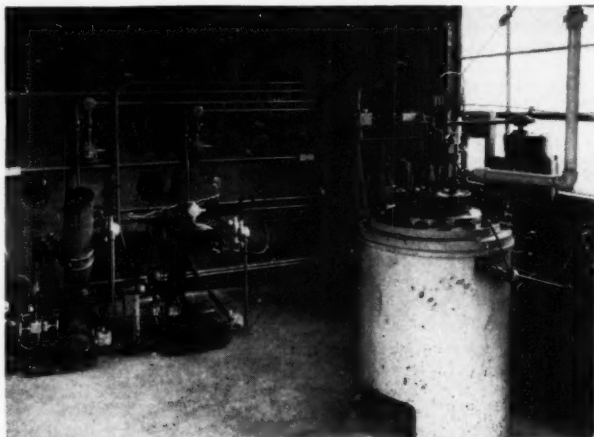
Brick removed from the mill at the end of the year's time is illustrated above. On the left is the new super brick which was worn down to thicknesses ranging from $1\frac{5}{16}$ in. to $1\frac{7}{16}$ in. On the right is the regular porcelain brick worn to thicknesses ranging from $\frac{3}{8}$ to $\frac{1}{2}$ in. It was noted that all balls were worn smooth and uniform with no evidence of chipped or broken balls.—McDanel Refractories, Beaver Falls, Pa.

Autoclave Agitator Is Magnetically Driven

An autoclave of German design and manufacture having a magnetically operated agitator is now available through a United States distributor. Through use of a magnetic agitator, the conventional stuffing box has been eliminated.

Agitation produced is of the pulsating type as a perforated plate or plates mounted on the vertical shaft are alternately lifted and dropped by the action of an external magnet.

Standard units are furnished in sizes up to 27.5 gal. Autoclaves larger than this need multiple agitators.—Chemtech Products Corp., 801 2nd Ave., New York 17, N. Y.



HIGH PRESSURE AUTOCLAVES PREPARE NEW DRUGS

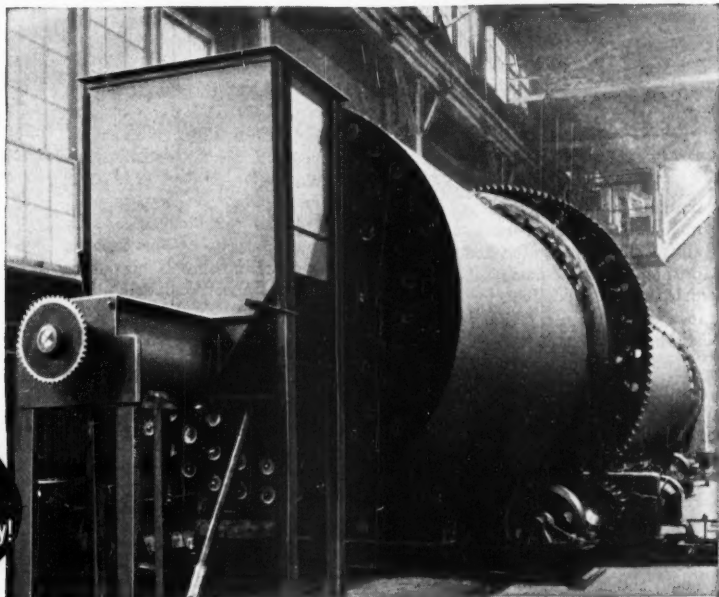
These autoclaves are housed in a new laboratory designed to prepare drugs for medical research. Large autoclave will operate up to 5,000 psi. at 400 deg. C. Two small autoclaves will hold 8,000 psi. at similar temperature. Technicians control operations from behind thick concrete wall in background. All possible safety features were included in design.—Wm. S. Merrell Co., Cincinnati, Ohio.

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LOUISVILLE ROTARY DRYERS utilize 85% of all available heat in steam!

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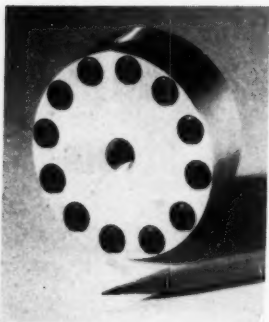
Dryer Sales Office: 139 So. Fourth Street, Louisville 2, Kentucky

General Offices: 135 South La Salle Street, Chicago 90, Illinois

Offices in all principal cities

In Canada: Canadian Locomotive Company, Ltd., Kingston, Ontario

NEW INSTRUMENTS & CONTROLS



Pressure Gage Isolator Confines Corrosives

The Trans-Sonics Type 40 isolator separates corrosive liquids or gases from liquid filled pressure gages and other instrumentation systems. This permits standard commercial pressure transducers to be used for pressure measurements of highly corrosive agents.

Heart of the unit is a specially formed Kel-F diaphragm which separates the corrosive medium from the instrument system and is capable of transmitting pressures with negligible drop. The isolator may be used at line pressures as high as 1,000 psi. and will hold back total line pressure in case of instrument failure. To accommodate thermal expansion of the liquid and other volumetric changes, the isolator provides for displacements up to 0.1 cu. in.—*Trans-Sonics, Inc., Bedford Airport, Bedford, Mass.*

Thermocouple Accessories Round Out Pyrometer Line

Three new types of insulated thermocouple wire are being offered for a range of applications. Where true moisture-proofing and high abrasion resistance in the presence of acids or vapors is required, a plasticized polyvinyl chloride insulation is used. A second type of insulation made of non-impregnated glass fibre is designed for medium high-temperature testing work such as the determination of fractionating tower temperatures. In cases where good dielectric strength and abrasion resistance up to 1,600 deg. F. is necessary, a fibrous silica insulation is provided.

Still another accessory is a new screw cover thermocouple head for

protection against weather and corrosion. It can be used for single or duplex thermocouples or high resistance thermometer elements.—*Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44, Pa.*

Continuous Colorimeter Is Simple, Foolproof

Continuous color control of flowing or static liquids or gases is facilitated by a new flow colorimeter. It is said that analytical accuracy within 0.5% can be obtained over a spectral range from 350 to 1,000 millimicrons.

In operation, the instrument passes light through an air path to a reference photo tube. A comparison is made between the intensity of this light beam and one passing through the flowing sample to a measuring photo tube. Light source to both photo tubes is supplied by a single tungsten lamp. Thus, both photo tubes are affected equally by variations of light intensity, thereby eliminating need for special monitoring circuits.

Light reaching the reference photo tube passes through a filter. Selection of this filter determines which part of the spectral region is isolated. The other light beam passes first through a collimating lens to the filter, then through sample to photo tube. Difference in response of the two photo tubes regulates the position of the needle on a millimeter scale.

Meter readings can quickly be converted directly into concentration of gas or liquid in a sample. Either a potentiometer type recorder or a standard recorder-controller can be used with the unit.

When handling highly corrosive gases or liquids the instrument can be continuously purged with inert gas. Also provision is made for constant temperature control.—*Beckman Instruments, Inc., South Pasadena, Calif.*

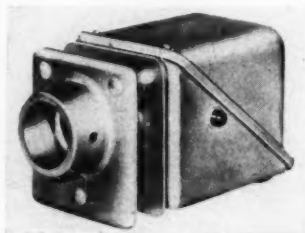
Instrument Valve For Panel Mounting

A series of direct mounting instrument panel valves for use on medical and industrial equipment, as well as for general instrumentation, has recently been announced. These valves are designed for direct panel mount-

ing and are attached to the panel through a single mounting hole. A wide variety of thread sizes and styles in brass, stainless steel and aluminum are available. All parts of the valve appearing from the panel front, including the lock nut, are finished in dull nickel. A black plastic handwheel permits easy valve adjustment.—*Hoke, Inc., 139 So. Dean St., Englewood, N. J.*

Consistency Regulator Operates Pneumatically

Pneumatic controls and air-operated dilution water valve are now offered as optional equipment with the Bird consistency regulator. Use of this new control equipment provides a permanent continuous record of incoming and outgoing paper stock consistency. Adjustment in desired consistency may be made at the controller by the simple turn of a knob. Control within plus or minus 0.1 percent is provided.—*Bird Machine Co., South Walpole, Mass.*



Flame Failure Safeguard Uses Photoelectric Eye

Flame failure protection of commercial and industrial oil-burning equipment is provided by the new fire eye Type F 18T-3. Manually ignited oil burners, air heaters, ovens, kilns, as well as automatically ignited oil burner installations can all be adequately protected from flame failure by this device.

The phototube and amplifying system are housed in an aluminum case which is thermally insulated so that the control may be mounted directly on the furnace wall. A hermetically sealed time delay element prevents the flame relay from dropping out due to purely transient disturbances.—*Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.*

which OF THESE MATERIALS IS BEST FOR *your* CORROSION PROBLEMS?



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Economical, universal protection against all alkalis, metallic salts, practically all inorganic acids, hydrochloric acid any strength, sulphuric to 50%, nitric to 20%, phosphoric to 75%. Good to 160° F. — sometimes higher. Ask for details of Ace two-layer lining system.



• ACE SOFT RUBBER LININGS

Corrosion resistance near that of hard rubber . . . recommended where abrasion, mechanical abuse, or temperature variations are problems. At left is 12,000 gal. outdoor acid storage tank, lined with soft rubber.



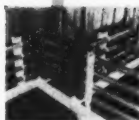
• ACE SYNTHETIC RUBBER LININGS

Many types available for handling oils, gasoline, other organic corrosives. Often used for higher heat resistance. Evaporator head at left, for instance, works at 212° F.



• ACE MOLDED HARD RUBBER PARTS

Many parts can be produced most economically by molding. This chlorine gas cell cover is example. Many large shapes can also be fabricated by special hand-wrapping process.



• ACE HARD RUBBER PIPE AND FITTINGS

Two types: (1) All hard rubber, threaded pipe for service to 50 psi., 120° F. (2) Rubber-lined steel, flanged pipe for pressures to 125 or 250 psi. Have same fine chemical resistance as tank linings.



• ACE SARAN

Saran pipe, tubing, fittings, diaphragm valves, special molded parts, etc., have unusual resistance to chemical attack at room temperature. Dimensionally stable. High strength.



• ACE PARIAN

Slightly better resistance at room temperature to moisture and chemicals (except acetic acid) than Saran. High impact strength. Odorless, tasteless, non-toxic, good for handling foods. At left: Parian diaphragm valve.



• ACE-HIDE

New resin-rubber blend combines unusually high impact strength and toughness with light weight and good chemical resistance. Available in molded parts. At left is standard 3-gal. Ace-Hide acid pail.



• ACE-TEX

Low cost pyrobituminous molding compound has excellent resistance to strong alkalis, calcium chloride, hypo, sulphuric acid to 1.30, etc., but poor resistance to organic solvents and oils. Good for small tanks, etc.



• TEMPRON

New heat-resistant Buna-N compound handles many corrosives to 200° F. and above. At room temperature has better resistance to organic chemicals than natural rubber or plastics. Pipe, fittings, fabricated parts, etc.



With literally hundreds of rubber and plastic compounds to choose from, we can usually supply the one best, most economical material for any corrosion problem. Pumps, tanks, piping, valves, utensils, and special molded or fabricated parts. Ask for our recommendations.

ACE[®] rubber and plastic products

AMERICAN HARD RUBBER COMPANY
93 WORTH STREET • NEW YORK 13, N. Y.

NEW PACKAGING & HANDLING EQUIPMENT



New Fork Truck Model Is Easily Maintained

Combining ruggedness and high serviceability the new model Utilitrac is said to feature major improvements. Compact in every respect, these trucks have a turning radius well within the limitations of practical aisle width, and are highly maneuverable in close quarters. Increased driver visibility also has been provided.

Belonging in the 6,000 to 7,000 lb. range the Utilitrac is available with either gas or electric power. The gas model is fitted with a quick change clutch or an optional Dynatork drive for increased smoothness of operation. Automatic acceleration is featured on the electric model while travel and lifting speed have been increased.—Clark Equipment Co., Industrial Truck Div., Battle Creek, Michigan.

Hydraulic Diverter Valve Ups Fork Truck Utility

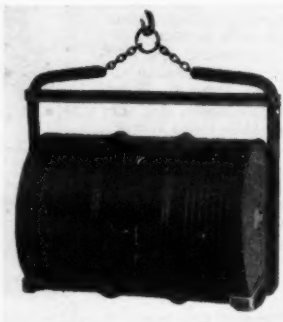
A newly designed diverter valve makes possible the economical field installation of a number of special hydraulic attachments for fork trucks. By use of this valve, the truck's hydraulic system which operates the up-right can be utilized to work the attachment, using the standard tilt lever as the means of control. Simultaneous operation of the attachment and the tilt cylinders is impossible.—Clark Equipment Co., Industrial Truck Div., Battle Creek, Michigan.

Pallet Roller Eases Unloading Job

Loading and unloading operations between trailers and docks is said to be streamlined by using a new pallet

roller to move unit palletized loads. After an empty pallet has been placed on the roller it can be loaded and pushed off the truck or trailer onto the loading dock. Use of this procedure gives speed and economy by eliminating hand trucking, fork truck tie-ups and extra labor costs.

Roller frame is constructed of welded, high tensile strength steel angle. Rolls have large diameters and crowned ends and are mounted with heavy duty bearings on hexagonal non-turning axles.—Frank L. Robinson Co., Latham Square Bldg., Oakland 12, Calif.



Hoist Cradle Lifts All Barrels

This barrel cradle is recommended for picking up any type of barrel. Plywood or fiber drums, straight or bilged sides, flat or chimed ends are all said to be handled equally well.

Model shown accommodates barrels from 20 to 25 in. diameter and 32 to 36 in. long. Construction is welded heavy bar stock. Capacity is 1,000 lb. with special sizes built on order.—The Palmer-Shile Co., 16037 Fullerton, Detroit 27, Michigan.

Drum Pallet Doubles Storage Capacity

Engineers at the East Pittsburgh Westinghouse plant have developed a pallet for handling and storing drums. Drum storage capacity is said to have been increased 100 percent through use of this pallet. Reason for this lies in ability to stack drums four tiers high, using the pallet, as against two-tier manual stacking formerly employed.

Pallets are built with narrow wood

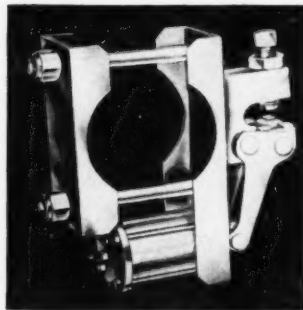
stringers running lengthwise to hold the drum securely in place. Each pallet holds four drums at one time. Drums unloaded from box cars are rolled onto these pallets and taken by fork truck to storage area.—The Baker-Raulang Co., Baker Industrial Truck Div., 1230 West 80th St., Cleveland 2, Ohio.

Lighter Fork-Lift Truck Is More Powerful

The improved Yardlift-150, pneumatic-tired fork-lift truck features increased horsepower, lighter weight, and better hydraulic steering for increased operating ease.

This 15,000-lb capacity truck now weighs 2300 lb less. A new power plant develops more horsepower at fewer rpm. This means more work with less wear and resultant longer engine life.

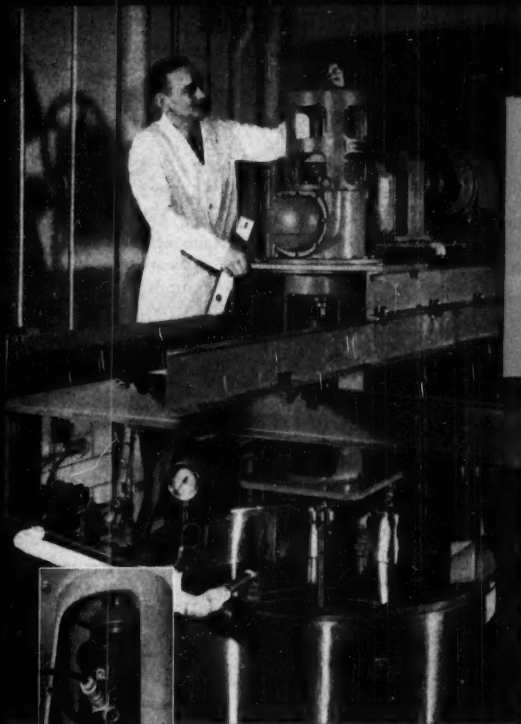
Other improvements give increased driver vision and ease of steering.—Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.



Vibrator Mounting Clamp Is Air-Actuated

The mounting clamp is designed to speed attachment of external vibrators in desired position. The air vibrator is held by the large clamp on the left. The air-operated piston at the bottom closes the clamping jaws on the right to hold the vibrator on any suitable steel member.

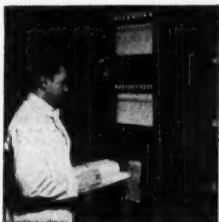
This device is particularly advantageous for unloading operations where only short vibration periods are needed. Only a few seconds are required to attach the device, eliminating lengthy installation time.—Viber Co., 726 South Flower, Burbank, Calif.



MEASURING POWER CONSUMPTION of mixer impeller. Mixer shaft is fitted with electronic torque meter. Power consumption is recorded continuously on a strip chart, as part of data required for accurate sizing.



TEST TANK is fitted with dual-wound helical coils that permit steady-state temperature conditions while testing. Thermocouples in coil walls record data on point conditions.



RECORDING POTENTIOMETER automatically plots temperature data from thermocouples, on as many as 32 stations, one every 3 seconds, for accurate calculation of heat transfer coefficients.

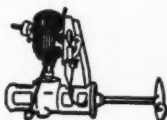
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¼ to 500 HP

HIGH-EFFICIENCY HEAT TRANSFER IN TANKS

How to get guaranteed results, minimum heating-cooling time, and accurate process control

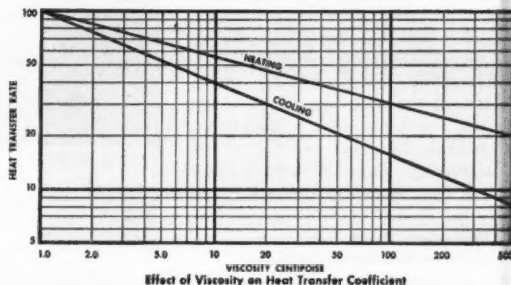
On any project involving heat transfer in kettles or tanks, check first with Mixco engineers. Their experience can help you arrive at:

- most efficient heating and cooling equipment (vertical tubes, helical coils, etc.)
- correctly sized mixer for exact temperature control
- accurate prediction of heating-cooling time
- fully guaranteed results

The answers on high-efficiency heat transfer are at your disposal, without cost or obligation. Facts are derived from hundreds of successful heat transfer installations using LIGHTNIN Mixers, plus constant research with up-to-date laboratory and pilot equipment.

For more details, call your LIGHTNIN Mixer representative. Or write us today, briefly describing your needs. For catalog information on LIGHTNIN Mixers, check and mail the coupon.

Research is key to good heat transfer



Graph shows the effect of viscosity on heat transfer coefficient. Similar data or flow rate, vessel size and shape, impeller size, shape, location and other variables enable MIXCO Engineers to accurately specify heat transfer conditions for your particular process.

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| <input type="checkbox"/> B-104 Side Entering Mixers | <input type="checkbox"/> DH-50 Laboratory Mixers |

Name

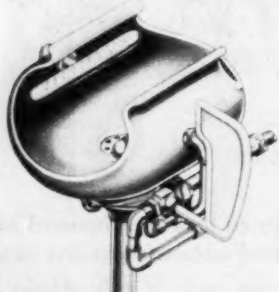
Title

Company

Address

City Zone State

NEW SAFETY EQUIPMENT



Eye Wash Fountain Floods Facial Area

In response to a claimed increase in the number of facial accidents involving acid burns, dust, fumes, heat and contamination, a new eye wash fountain is being offered. This fountain is designed to gently spray a large volume of water over the facial area at essentially neutral pressure without danger of recontamination. It is said that the design is the first one to fully meet all known industrial hygiene recontamination regulations and plumbing and sanitary standards.

The fountain bowl is porcelain enamel, while piping and fittings are chromium plated red brass. Actuation of the water flow is by a non-leak, bat-wing valve. Models are available for either pedestal or wall mounting.—*Logan Emergency Showers, Inc., Box 111, Glendale, Calif.*

Mercury Trap Prevents Manometer Loss

Mercury which is blown from manometers can be trapped and recovered through use of the new Mercureceiver. Captured mercury can be removed from the trap by draining or by blowing it back into the manometer with application of more than 25 psi. pressure. Mercureceivers are installed at both ends of differential manometers and to the open end of absolute manometers.

This unit is also designed to filter actuating media and to remove harmful solids from the actuating media. Fabrication is of moly or stainless steel with threaded end fittings and porous stainless steel membranes.—*The Emil Greiner Co., 20-26 N. Moore St., New York 13, N. Y.*

Extinguisher Horn Is Now Grounded

Portable carbon dioxide fire extinguishers fitted with plastic discharge horns give the operator a jolt from a static electric discharge. The cause of this is the friction produced against the inside of the plastic horn by the high velocity discharge of carbon dioxide.

The Alasco anti-statik horn eliminates the possibility of static electricity discharge. A pair of copper conductor strips bolted in place along the inside surface of the horn and connected through to the carbon dioxide cylinders carry away the static charge as rapidly as it is produced.—*American-La France Foamite Corp., Elmira, N. Y.*

Lightweight Fire Shield Protects Fire Fighters

A new lightweight fire shield, weighing only 26 lb, protects fire fighters against radiant heat when working close to a fire. The shield insulating properties are provided by a blanket of Ultralite glass-fibre insulation fitted to a framework of tubing. A peep hole for visual observation of the fire is shielded by copper wire that disseminates and dissipates the heat. A hose nozzle opening may easily be cut through the shield wherever desired for ease of operation.

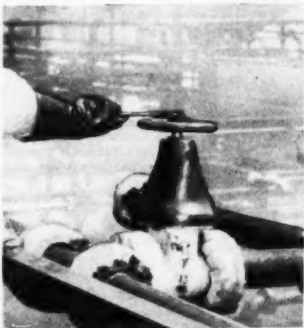
Two or three-man shields mounted on wheels are also available. The cost of the one-man shield is \$75.—*Gustin-Bacon Mfg. Co., Kansas City, Mo.*



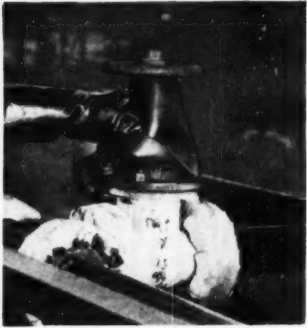
VALVE SHIELD is cut to slide over.



VALVE STEM and around valve body.



VALVE WHEEL is then secured.

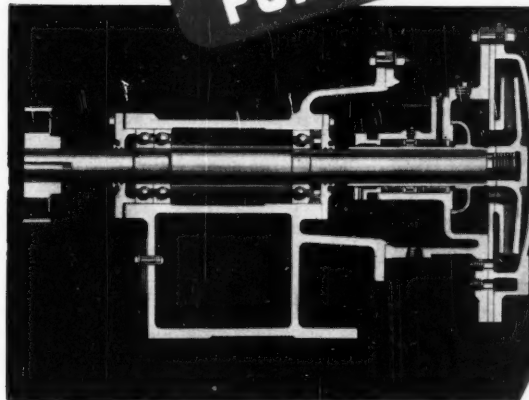


GLAND LEAKS are no longer a hazard.

FLEXIBLE VALVE SHIELD PROTECTS OPERATOR

Safety engineers in the Du Pont company have found this valve shield very effective for protecting operating personnel from valve packing gland failure. Molded of neoprene, in the form of a flower pot, the shield is available in three sizes. You simply cut a hole in the bottom of the shield slightly smaller than the valve stem diameter. Then place on valve as shown.—*Industrial Products Co., 2820 N. Fourth St., Philadelphia 33, Pa.*

**ALLIS-CHALMERS
PROCESS
PUMPS**



OPEN impeller



OR



CLOSED impeller

***Now* INTERCHANGEABLE With NO OTHER Modification**

YOU CAN DO MORE JOBS WITH ONE PUMP if it is an Allis-Chalmers Process Pump. You can interchange open and enclosed impellers without making any change whatever in the rest of the pump. Simply remove one impeller and replace it with the other. If you use both open and enclosed impellers in the same plant, your parts stock is reduced because all parts are interchangeable.

ADJUSTABLE FOR WEAR

Both open and enclosed impellers have flat wearing clearances which may be adjusted for wear without dismantling the pump by a simple shimming arrangement. Thus tight clearances and original efficiency

may be maintained over long periods.

Allis-Chalmers Process Pumps are particularly useful where corrosion or abrasion make it difficult to keep packing in the pump. The packing is on the suction side which limits pressure on the packing to suction pressure. The *Equeiseal* sleeve further reduces pressure on the packing. Packing life is greatly prolonged.

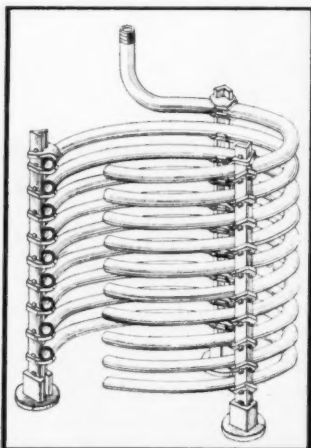
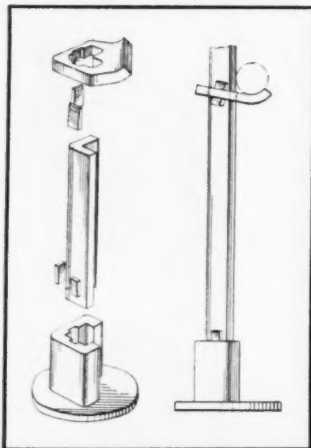
To get full information on Allis-Chalmers Process Pumps and how they can reduce your pumping costs, call your nearby Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 08B6615.

A-3868

Equeiseal is an Allis-Chalmers trademark.

ALLIS-CHALMERS





COMPONENTS. . . SUPPORTER. . . COIL mounted on supporter.

Lead-Clad Steel Supports Coils

Savings in material, weight and labor are realized by using this lead-clad steel pipe-supporter assembly to hold lead coils. Service life is increased.

People engaged in the processing of corrosive acids have long faced the problem of satisfactorily installing lead heating and cooling coils. Now comes an apparent answer to this problem with the introduction of the Knapp universal pipe supporter. This unit combines the use of Ferrolum lead-clad steel with a new design for leg, base and supporting bracket to give an assembly which is light, sturdy, and easily erected.

For a good many years it has been standard practice to fabricate lead coils with lead legs which act to separate the pipe turns while tying the coils together and supporting them. Although this has licked the corrosion problem, several inherent difficulties have resulted. First, the lead legs are extremely heavy and increase overall coil weight objectionably. Second, the cost of this excess weight of metal is considerable, and the labor involved in lead burning is excessive. Third, in the presence of temperature cycles the lead supporting members frequently buckle, distort and tend to collapse.

To overcome these several diffi-

culties, lead-clad steel was used in the fabrication of the Knapp universal pipe supporter. This material combines the corrosion resistance of lead and the physical strength of steel while reducing weight and material cost. Furthermore, since the lead is chemically clad to the steel, expanding and contracting with the steel under temperature changes, this material has the strength and rigidity of steel and is not affected by temperature cycles.

After establishing a satisfactory construction material, it was necessary to evolve a supporter design sufficiently versatile for use with all industrial variations in coil design.

The supporter assembly developed consists of four Ferrolum components. These are pictured above, and are as follows: (1) An angle or bar for the leg, (2) a stand to support the leg, (3) a self locking cradle to support the pipe turn, and (4) a wedge which further secures the cradle and makes permanent the spacing of the pipe turns.

In practice, the cradles may be readily slipped on to the leg and positioned as desired. A sufficient num-

ber of legs are used to support the coil being installed. It can be seen that use of this assembly completely eliminates lead burning.

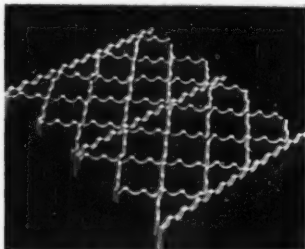
Since the coil pipe merely lays in the cradles and is not locked in position, it is free to expand or contract under temperature changes.

The leg members may be obtained in long lengths and cut to desired installation length as required. A simple lead cap is applied over the cut ends. Cradles are furnished in two sizes to accommodate pipe diameters from 1 in. O.D. to 2½ in. O.D. Components may also be obtained in stainless steel or other corrosive resistant metals, as well as in carbon steel.—Knapp Mills, Inc., 125 Broad St., New York 4, N. Y.

Rubber Matting Scrapes Feet Clean

A new chemical and grease-proof matting constructed with wedge-shaped ridges is said to give a very efficient scraping action when walked on. This matting is made of nitro-crylic synthetic rubber which is resistant to most chemicals and petroleum derivatives.

Matting is furnished in white or steel gray 3 ft. wide and any length up to 60 ft. All edges are beveled.—A. N. Braybook, 18 E. 49th St., New York 17, N. Y.



Slip-Proof Grating Has Serrated Edges

A new ¼-in. stock grating is said to prevent walking hazards due to oil, grease or water. Skid resistance is obtained by serrating the upper edges of the grating. This gives sure footing, but is still comfortable to walk and stand on.—Bustin Firm Grip Grating Corp., 110 E. 130th St., New York 37, N. Y.

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

This Refinery asked:

Can you clean open box condensers?

before

after

Dowell Service cleaned **THREE** in 10 hours!

A hard calcium carbonate and iron oxide deposit, $\frac{1}{8}$ to $\frac{1}{4}$ inch thick, had formed on the tubes of three open box condensers in a southwestern refinery. Dowell Service removed an estimated 99% of these profit-stealing deposits, in just 10 hours.

Before cleaning, the polymer product left the condensers at 125-140°F. After Dowell Service, the product left at 110°F. with reduced water flow through the boxes. This additional cooling resulted in a $3\frac{1}{2}\%$ to $4\frac{1}{2}\%$ increase in polymer yield. The amount of uncondensed gas was reduced by $\frac{1}{4}\%$ to $\frac{1}{2}\%$.

Dowell engineers successfully cleaned these condensers using special liquid

solvents and Dowell-designed pumps and control equipment. The solvents, introduced through regular water connections, penetrated to all parts of the boxes and dissolved and disintegrated the deposits.

Call on Dowell for advice on *your* maintenance cleaning problems. Dowell Service methods are applicable to cleaning many different kinds of refinery equipment *without dismantling and with a minimum of downtime*—for example, condensers, process towers, pipe lines, storage tanks, boilers and cooling jackets. Experienced Dowell engineers will be glad to show you how they can save you real dollars in your plant maintenance program.

Other recent Dowell jobs:

Two comingler condensers in a catalytic cracking plant were cleaned without interrupting operation. Result: Pressure drop across units reduced from 28 lb. to 2 lb.

The tubes in four reactor condensers were 85% filled with a wax and oxide deposit, due to unremoved catalyst in the gas oil product. Dowell Service completely cleaned these condensers in 14 hours.

Heavy ferrous ferrocyanide deposits built up on the trays and caps of the bubble-cap rectifier column in a catalytic cracking unit. Dowell Service removed this deposit in just 27 hours.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

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Beaumont, Texas
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Wichita Falls, Texas
Hobbs, N. Mex.

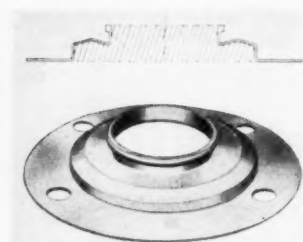
- ★ Maintenance cleaning service for industrial heat exchange equipment.
- ★ Chemical services for oil, gas and water wells.



DOWELL

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NEW ELECTRICAL & MECHANICAL EQUIPMENT



Teflon Parts Now Are Molded

Until very recently the use of Teflon has been somewhat restricted despite its outstanding properties. This is particularly true in the fabrication of relatively small parts, due to difficulty in working the material. Logically, small parts would be produced by compression molding. However, Teflon does not lend itself to ordinary methods of extrusion as do other plastic materials. Simple forms could be molded in Teflon, but intricate parts involving under cuts and other difficult forming details seemed impossible to mold.

This difficulty has been partially overcome by making simple extrusions of Teflon, followed by machine finishing. Such a procedure has involved excessive loss of expensive material, increased cost, and a low production rate.

New procedures have now been developed whereby intricate Teflon parts can be production molded. Costly machining steps are thereby eliminated and new possibilities for parts manufacture opened up. The part pictured above, with its deep undercut, gives you an example of this latest achievement in molded Teflon parts.—Sparta Heat Treat Co., Plastics Div., East Sparta, Ohio.

Aluminum Busbars Used in Feeder

Aluminum busbars with their inherent advantages are now being extensively used in the Flex-A-Power feeder or plug-in electrical distribution system. Weight savings from 30 to 70 percent are being realized through use of this material.

Tests have established that LVD-5 Flex-A-Power has exceptionally high transmission efficiency with minimum

voltage drop. Further, the availability of aluminum is almost assured during emergency periods.

Aluminum LVD-5 Busways are listed by Underwriters Laboratories for these ratings: From 600 to 4,000 amp. at 600 v. or less for 2-pole, 3-pole, 3-phase, 4-wire and 4-pole systems. The FVK line with aluminum busbars is available in ratings of 225, 400, 600 and 800 amp. at 600 v. or less.—Trumbull Electric Dept., General Electric Co., Plainville, Conn.

Volt-Ammeter Covers Nine Ranges

A new pocket-sized volt-ammeter, the Amprobe 300, covers six ampere ranges from 0 to 300 amp. a.c. and three voltage ranges from 0 to 600 v. a.c. Current readings can be made instantly without shutting down equipment for making connections because the instrument is the snap-around type.

Voltage test leads are equipped with new retractable safety plug which automatically insulates itself when removed from meter. The jaws are completely insulated down into the socket, protecting against shorts and shocks. Probe jaws are pointed

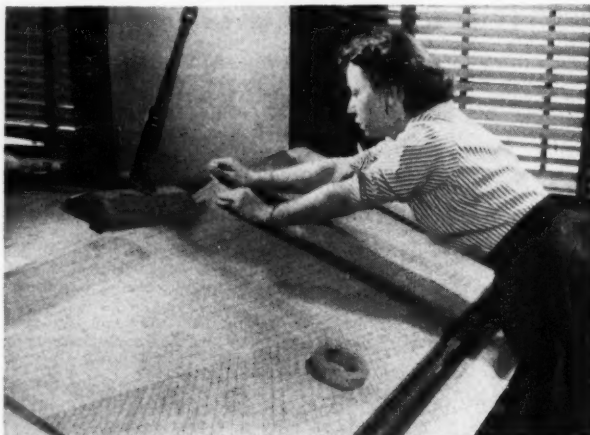
for working in crowded switch and terminal boxes.

Cost of the Amprobe 300 is \$49.50, complete with top grain cowhide leather case and voltage test leads.—Pyramid Instrument Corp., Lynbrook, N. Y.

Screw Fastener Has 12-Point Head

Precision forged screw fasteners of all types are now being manufactured with non-slip 12-point heads. These heads looking much like a small gear are said to provide a non-slip grip for either socket or box-type standard 12-point wrenches. Because there is no place for metal movement, there is no wrench slipping which eliminates the possibility of burred or chewed-up heads. The tapered head and shoulder of the fastener provide a frictional lock holding the fastener in the wrench head without danger of slipping and finger injuries.

Initial cost of the 12-point fastener is only slightly higher than that of the conventional type. However, this is readily offset by time and labor-saving features.—Twelve-Point Fastener Co., 4517 Lorain Ave., Cleveland, Ohio.



PERSPECTIVE VIEWS DRAWN USING GRAPH PAPER

Use of this graph paper permits scaling directly from an engineering drawing into an accurate perspective view. Six grid planes on the graph are graduated in true perspective foreshortening so that you can plot and project dimensions. Seven basic graphs furnish a variety of perspective angles. Drawings can range in size from 8 x 10 in. to 30 x 60 in.—Tech-Art Graphs, 315 S. 15th St., Philadelphia 2, P.

Now, more than ever, valves must be **DEPENDABLE**

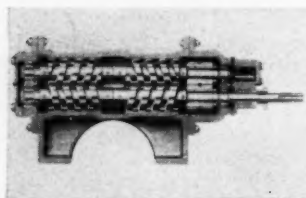
In these days when peak production is so essential, you can't afford to have your operation interrupted by the failure of a valve. Powell Valves are designed and made to stand up under even the most exacting service conditions.

The Wm. Powell Company
Cincinnati 22, Ohio

Fig. 2453-G. Large
150-pound O. S. & Y.
Gate Valve. All the
dimensions conform to
the latest standards.
Can be furnished in
Stainless Steels
Hastelloy Alloys
Monel Metal
Herculoy
Everdur
Inconel
Nickel and
other metals
and alloys.



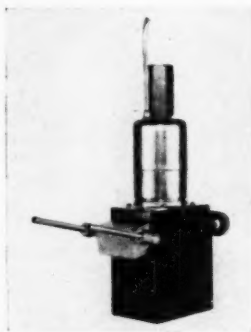
NEW FLUIDS HANDLING EQUIPMENT



Screw Pump Has Internal Bearings

A new pump for positive displacement of lubricating fluids or semi-fluids has been designed with internal gears and bearings. Among the design features are location of the heavy-duty roller bearings just inboard of the timing gears where radial load is heaviest; lock nuts behind the timing gears for faster, simpler repairing; double roll angular contact ball bearings at the rear end which position the rotors axially for less wear on bearings and timing gears.

These pumps are available in capacities ranging from 1 to 700 gpm, and discharge pressures of 1,000 psi. for viscous liquids and 500 psi. for light oils.—*Sier-Bath Gear & Pump Co., Inc.*, 9252 Hudson Blvd., North Bergen, N. J.



Restrictor Valve Gives Very Low Flow

The Bourdon restrictor valve is an extremely low flow valve with an unusual design. It features packless construction and accomplishes exceptionally wide rangeability through use of a Bourdon tube whose cross-section is varied to restrict flow. Wherever accurate regulation of low liquid or gas flows is required, this valve is a useful tool.—*The Foxboro Co.*, Foxboro, Mass.

Multi-Stage Pump Is Now More Efficient

Ingersoll-Rand has redesigned its class CNTA line of horizontal multi-stage pumps for medium pressure applications. By incorporating modern hydraulics it is said higher efficiency and better operation have been obtained.

Rotor assembly is composed of shaft, impellers and channel rings which contain multiple volute fluid passages. Entire assembly is completely balanced to eliminate radial thrust under all operating conditions. Back-to-back grouping of impellers neutralizes axial thrust developed by pressure differential across each individual stage.

Pump casing is horizontally-split, smooth-bore cylindrical type. Rotor assembly is easily and quickly installed or removed from casing.

Pumps operate up to 800 psi. Sizes available are 1½, 2, 2½ and 3 in. with 4, 6 or 8 stages.—*Ingersoll-Rand Co.*, 11 Broadway, New York 4, N. Y.

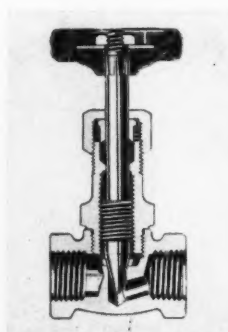
Process Pump Has Mechanical Seal

The new Type CTB process pump is said to offer sizable reduction in seal and pump cost through the use of a mechanical shaft seal in place of the usual stuffing box. Use of this type seal is said to virtually assure prevention of leaks along the pump shaft.

Designed for low-temperature, low-pressure chemical transfer service, the pump is a horizontal end-suction top-discharge type with vertically-split case. Built in four sizes, capacity range is from 10 to 250 gpm.; head range is 10 to 140 ft.; horsepower range is 1 to 10.

One feature included to provide optimum seal performance through reduction of pressure on the shaft seal is the use of repellant vanes on the back of the impeller shroud. This type of semi-open impeller design eliminates the need for wear rings.

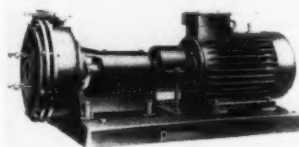
Also maximum capability is assured for handling abrasives. Pump has cast iron frame and No. 20 stainless steel (50 percent chromium-nickel content) liquid end. *Peerless Pump Div.*, 301 West Ave. 26, Los Angeles 31, Calif.



Needle Valve Gives Pinpoint Control

A new gland-type bronze needle valve is small and compact. Sizes available range from ¼ in. to 1 in. in both globe and angle patterns. The valve is said to be ideal for pin point control on small lines where fine regulation of flow is essential. A non-slip handwheel lends itself to finger tip control.

An indicator model of the same valve has a graduated handwheel and engaging spring clip, permitting setting and resetting the valve at any desired opening.—*The Lunkenheimer Co.*, Cincinnati 14, Ohio.



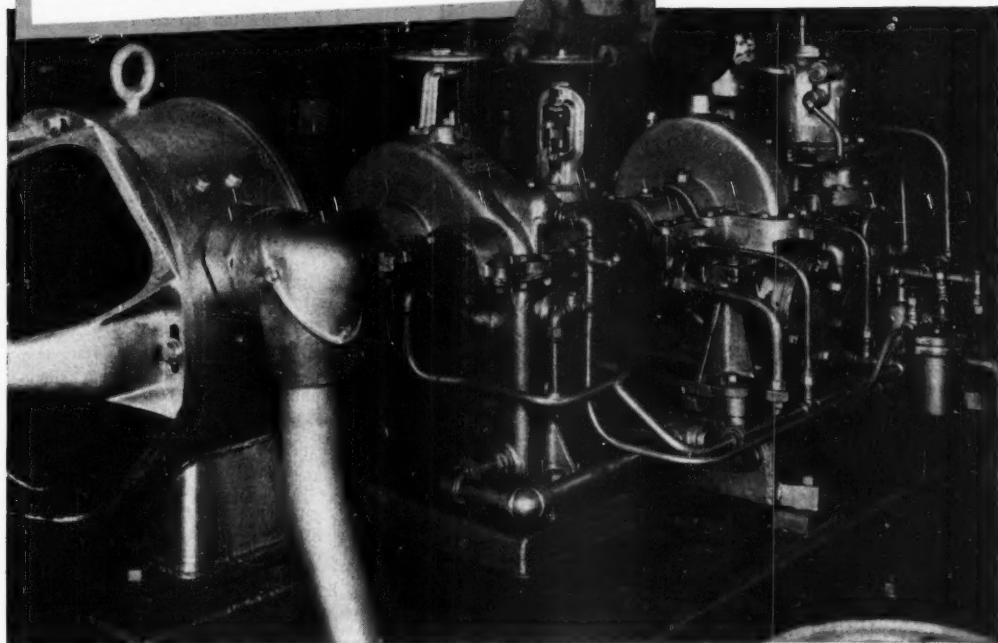
Acid Pump Has Corundum Parts

A new English pump utilizes corundum construction to eliminate acid corrosion and product contamination. Special design features meet the limitations of stoneware as a material of construction.

A single-inlet shrouded-type impeller made of special corundum having low porosity, high tensile strength, and a smooth even finish is accurately ground to run without vibration. A large shaft diameter assures freedom from vibration and distortion under working conditions. Special facings on the impeller keep

(Continued)

**Whether operation is
continuous or stand-by...**



TYPE E turbines can handle it!

In the powerhouse of William F. Schrafft & Sons, makers of the famous "Schrafft's Chocolates," Charlestown, Massachusetts, the Type E turbine is used on a 40-kw, d-c exciter. The turbine exciter is supplementary to a motor-driven exciter for one 750- and two 1000-kw Westinghouse Turbine-Generators.

Of this installation, both the Chief Engineer and the Chief Power Plant Operating Engineer stated, "We are impressed by the design, appearance, and smooth-running qualities of the Type E turbine, and also the unique design of the oil-relay governor and forced-feed lubrication which the Type E provides." This all-Westinghouse end of Schrafft's power plant includes a new 1000-kw Westinghouse Geared Turbine-Generator, served by existing Westinghouse switchboard equipment and motor-generator sets.


Here's the general-purpose turbine that meets the many stern demands of modern industry. Regardless of operating conditions, the Type E is built to give dependable, trouble-free, economical performance for long periods of continuous operation . . . or instant operation when used as a stand-by drive.

Other types in the complete Westinghouse general-purpose turbine line include heavy-duty and multi-stage units for applications requiring higher temperatures and pressures, higher speeds, greater horsepower, extraction for process applications or higher efficiency than can be obtained with single-stage machines. Get the facts on this broad turbine line . . . call your nearby Westinghouse Office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-50540

YOU CAN BE SURE...if it's
Westinghouse

TYPE E Turbines



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FASTENINGS**
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This handy slide-chart instantly identifies A-N Nos. pertaining to stainless steel nuts, screws, bolts, rivets, cotter pins, washers; gives sizes and other data. Write for "Chart 52D" TODAY!

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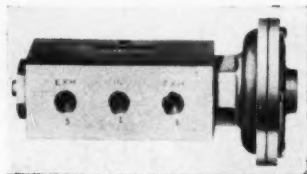
**25 YEARS OF
LEADERSHIP
IN FASTENINGS OF
STAINLESS STEEL**



EQUIPMENT NEWS, cont. . .

pressure on the packing at a minimum.

The Pulsometer-Doulton stoneware acid pump is available in three sizes for capacities up to 450 gpm. and heads up to 140 ft.—Pulsometer Engineering Co., Ltd., Reading, Pa.

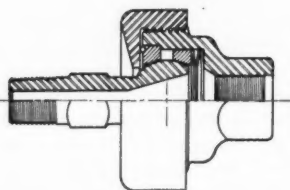


**Diaphragm Plunger Valve
Uses Low Air Pressure**

This newly introduced single-plunger valve is for use when only low-pressure air is available for the pilot control. Diaphragm operated with a spring return, this unit can be actuated with 12-15 psi. instrument air.

The manufacturer claims utmost simplicity of design and extreme ease of operation. Valve housing is aluminum, with stainless steel plunger.

Suitable for use with air, oil or water on line pressures from vacuum up to 125 psi., the valve can be furnished tapped for either $\frac{1}{4}$ in. or $\frac{1}{2}$ in. pipe connection. Also it is available in either two-way, three-way, double two-way, four-way, or five-way design. Recommended operating temperature is less than 150 deg. F.—D. C. Hunt & Son, Inc., Salem, Ohio.

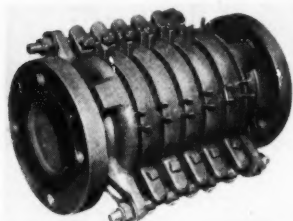


**Flexible Ball Joint
Works at High Pressure**

Now available for use on working pressures up to 7,500 psi. is a fire-proof, all-steel flexible ball joint produced in steel and alloy steel. Design differs somewhat from lower pressure joints in that the inner seal on the ball is a free floating part carried under constant spring pressure. This insures positive leakproof sealing at reduced pressure, and also makes the joint easy to turn and move. All steel

construction and metal seals provide complete protection against fire.

In addition to being suitable for applications in the petroleum field, these joints can be used in chemical and high-pressure steam power plants for service on steam up to 1,000 deg. F. and 1,500 psi. Sizes available are 1 in., 2 in., 2½ in., 3 in., and 4 in.—Darco Mfg. Co., Dept J-18, 1801 Winnemac Ave., Chicago 40, Ill.



Shorter Expansion Joints Give More Motion Control

The Flexon line of expansion joints has been improved to give greater pipeline motion control with decreased over-all expansion joint dimensions. Both the free and control types of Flexon joints have been modified to increase the stroke per corrugation. Expansion joints are now limited to ten corrugations per unit. Reduced welds and lengths have been standardized and flange hub lengths have been changed. The over-all gain for the user is in the ability to accommodate expansion with fewer corrugations.—Expansion Joint Division, Flexonics Corp., 1317 South Third Ave., Maywood, Ill.

Motorized Valve Controls Acid Flow

The flow of corrosive fluids such as acid mine water, sulphuric and sulphurous acids can be controlled by the new Mercoid motorized valves, series G2-64 and G3-64. These valves are constructed of stainless steel for corrosion resistance.

Valve is a two-wire motor-driven current failure type of valve operating on hydraulic principles. The G2-64 series rated for 275 lb. at 250 deg. F. has an opening time of 40 sec. and a closing time of approximately 8 sec. The G3-64 series has an opening time of 120 sec., closing time 20 sec., and is rated for 600 lb. at 125 deg. F.—The Mercoid Corp., 4201 W. Belmont Ave., Chicago 41, Ill.

—End

AEROTURN "ON THE JOB"

DUST COLLECTORS

SPECIAL PURPOSE AEROTURN DUST COLLECTOR

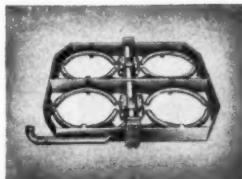
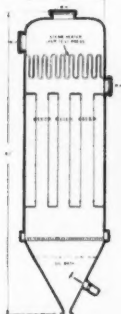
THE PROBLEM — to remove Hydro-Carbon Soot in a new chemical process for the manufacture of acetylene from natural gas. In addition . . .

1. The unit must be designed for continuous, automatic operation to insure process integrity.
2. The shell of the unit must be A.S.M.E. unfired pressure vessel code construction to withstand process pressures.
3. The unit must contain a heater section for reheating the process-gas stream.
4. The unit must be of spark-proof construction with no copper or copper bearing materials exposed to the process-gas.

THE SOLUTION By **AEROTURN** — T & H engineers, working in close cooperation with the designing engineers of the process, developed an advanced dust filter design—incorporating the high-efficiency and automatic self-cleaning feature of the standard **AEROTURN** Dust Collector which has been tested and proven in hundreds of installations.

This specially constructed **AEROTURN** Dust Filter has fulfilled the extreme and difficult requirements demanded by this important advancement in the field of chemical processing.

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AEROTURN'S EXCLUSIVE BLOW RING CRADLE used in the Standard Aeroturn Dust Collectors and adapted for use in any Special Application — Has patented, Fully Automatic, Self-Adjusting, Self-Aligning blow ring assembly which holds the rings snugly in contact with the wool felt filter bags at all times for maximum efficiency and filter bag service.

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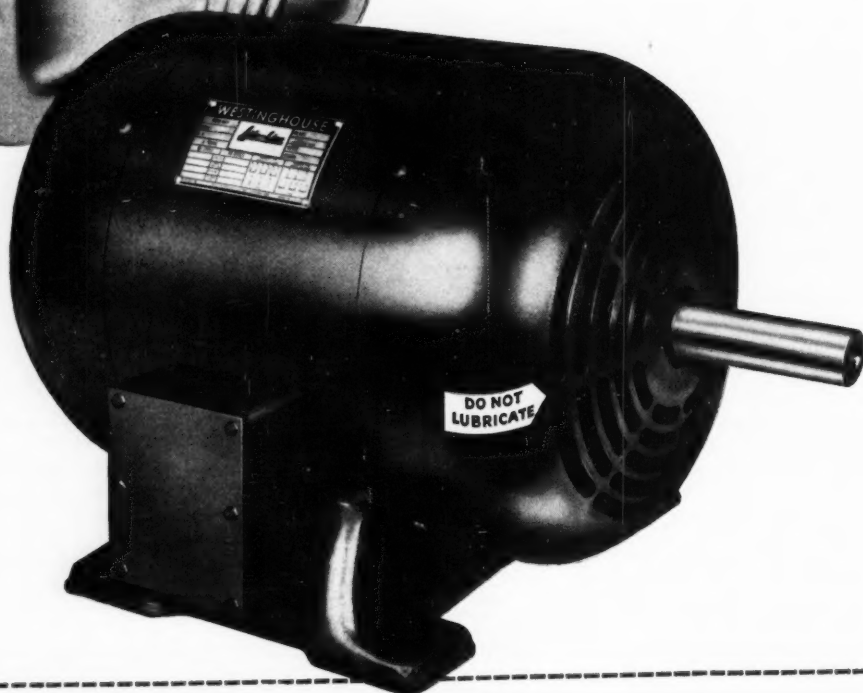
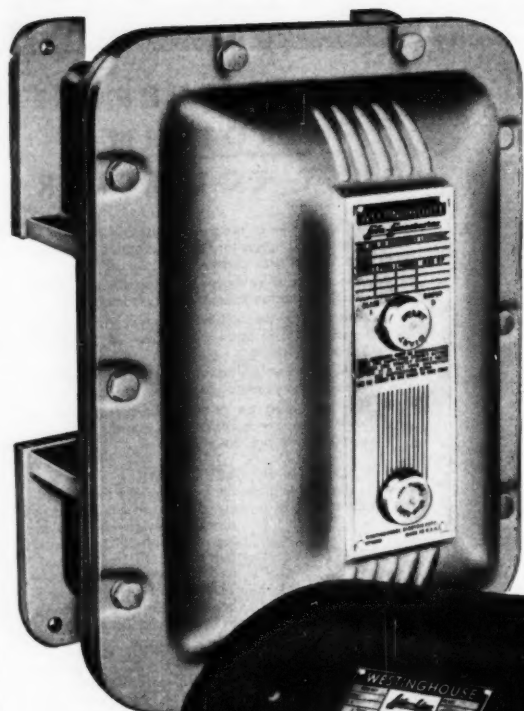
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WHAT ***Life-Lines*** REALLY DELIVER IS MORE SERVICE...LESS SERVICING

New chemical booklet

answers important motor and control application problems

You'll see answers to typical problems like these:

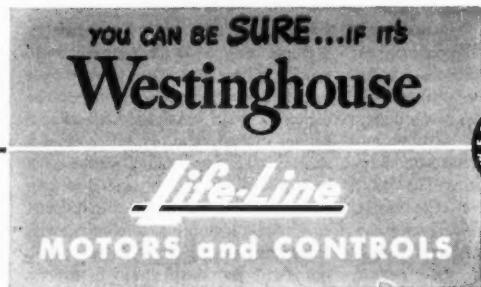
*the problem of corrosion . . . of hazardous locations . . . of dust and dirt
. . . of outdoor service . . . of shock and vibration*

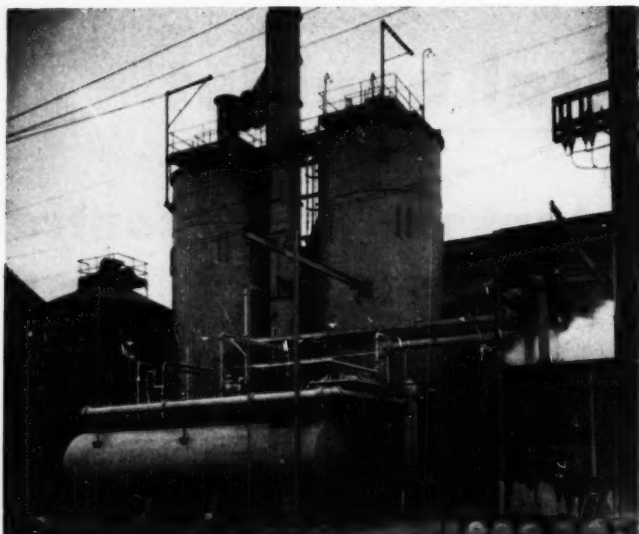
In addition, are discussions on lubrication, maintenance, installation . . . on centralized motor and control. In fact, it is the purpose of this booklet to analyze major motor and control application problems, and to provide solutions.

Also included, is information on Westinghouse motor and control equipment for chemical processing. You'll see why Life-Line chemical motors provide the best protection . . . how starters save servicing time. A comprehensive list of available literature with data is included, plus a postage-paid reply card for your convenience in ordering additional information.

Get the facts on the most complete and most advanced line of motors and controls available today. Ask your Westinghouse representative for your free copy of "Motors and Controls in the Chemical Industries," B-4792, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21698





SULPHURIC CONTACT PLANT is protected by one coat of new primer, two of vinyl.

“Prime and Paint” with Vinyls

Better primers are needed to take the application bugaboos out of vinyls. Now a new one has field tests to prove it takes a healthy swipe at the problem.

“Sure vinyls are good, but we can’t use them in our plant. Our painters can’t handle them. We don’t have the time and can’t afford to sandblast or do any other fancy cleaning. . . . We simply can’t make them work in our plant.”

This common cry among chemical plant maintenance engineers spurred development of Prufcoat Laboratories’ year-old Primer P-50. Now, according to general sales manager G. Russell Hersam, the maintenance chief can simply have his paint crew prime and paint with vinyl coatings—even over rusted surfaces—after only routine surface preparation such as wire brushing. Thus, he can exploit the outstanding protective qualities of vinyls* without the high cost of sandblasting or other specialized procedures.

*They resist acids, caustics, chemicals in general as well as severe combinations of weather, moisture, and abrasion. What’s more they’re nontoxic, odorless.

In a nutshell, here are the field-tested advantages of Primer P-50:

- Requires only routine surface preparation.
- Dries to tack-free surface in matter of minutes and after simple overnight drying can be topcoated with vinyl base paints and other active-solvent-resin-type coatings.
- Provides positive primer-to-surface and vinyl-to-primer adhesion.
- Assures control of sub-coating corrosion and rust creepage.
- Because of heavy-body and high total solids (roughly 65 percent), assures a substantial one-coat build whether it is sprayed or brushed.

In developing their new product, Prufcoat started with an oleoresinous-type primer known to have good inhibitive priming properties. Then they set about adapting it to the vinyls. But P-50 is said to be equally effective for oleoresinous and oil base paints.

It overcomes the big drawback to

wash primers—their complexity. The new protective system includes one coat of P-50 and two finish coats of vinyls. With wash primers, on the other hand, the system consisted of: (1) the wash primer; (2) a vinyl inhibitive tie-coat over the wash primer; and (3) vinyl finish coats over the inhibitive-tie coat. Furthermore, the wash primer by itself wasn’t a simple material to handle. It was packaged in two parts, had to be mixed in rather exacting proportions immediately prior to use and after mixing had a useful life of only 8 hours or so.

Sales manager Hersam has a file of case histories to show the ways in which P-50 has simplified coating problems in chemical plants. A typical story deals with a major eastern chemical company.

The maintenance executives of this firm knew well the value of a good, heavy-bodied inhibitive primer in chemical plant maintenance. Still their laboratory tests had also repeatedly confirmed the exceptional chemical inertness of vinyl protective coatings. But they were aware that the imperfect wetting, high surface tension and critical adhesion characteristics of these coatings frequently made them unsatisfactory for the great majority of plant jobs unless they went all out on surface preparation methods. Costs of this preparation ruled it out.

In places where they had tried to apply vinyls with only routine surface preparation, underfilm corrosion quickly took its toll and visual failure showed up rapidly. Net result was that they fell back on the conventional inhibitive-type of primer for widespread use in the plant. Since vinyls and other protective coatings were not compatible with this type primer, they went out the window.

This plant was one of the first to evaluate the new oleoresinous type primer. Their laboratory and field men tested the primer, proved it to be equal to their standard conventional primer in body and inhibitive characteristics. They soon adopted the oleoresinous primer for expanded use in their plant. Now, for the first time, this plant has been able to greatly extend the use of vinyl coatings without sacrificing the features of a good

conventional primer and without resorting to the special surface preparation and complicated priming procedures which time and cost factors formerly ruled out.—*Prufcoat Laboratories, Inc.*, 61 Main St., Cambridge, Mass.

Zinc Coating

May be applied at temperatures low enough to avoid distortion often caused by ordinary galvanizing.

A newly-patented Australian process is said to permit a permanent zinc coating to be applied to any iron or steel structure before or after erection. The process involves the application by brushing of Galvanite, a compound containing metallic zinc and other inorganic products in a water-soluble metallic silicate vehicle.

Galvanite is usually applied to surfaces that have been descaled by sand-blasting or wire brushing. After application, the treated surface is heated to a temperature of between 300 and 400 deg. F. to fuse the coating and make it insoluble in water. This low temperature is claimed to avoid the distortion which may be caused by ordinary galvanizing.

The process is said to give a weatherproof coating resistant to temperatures of up to 600 deg. F. in air, water and petroleum. The coating is also claimed to be impervious to food and fruit acids.—*Dimet Pty. Ltd.*, Melbourne, Australia.

Resin

Of the modified urea-formaldehyde type, it improves properties of a wide range of paper products.

A new low-cost modified urea-formaldehyde resin in aqueous solution is said to impart wet strength to a wide range of paper products. Called Uformite 711, it also improves dry tensile, mullen, fold and pick resistance. Wet rub of starch coatings also gets a boost from the new resin.

The cationic nature of Uformite 711 makes it adaptable to all types of pulp—bleached and unbleached, draft and sulphite and sulphite-groundwood combinations.

Freedom from sensitivity to sulphate ion is an important feature of Uformite 711. Preliminary tests in-

IN BRIEF—A capsulated listing of this month's newsworthy products

It's New . . .

Primer for Vinyls
Zinc Coating Resin
Steam Cleaning Compound
Gel Promotor
Salt-Free Sulphonates
Terramycin
Organic Silicofluorides
Wetting Agent
Dispersion Agent
Amyl Acetate
Dodecyl Diesters
Pigmented Primer
Cation Exchange Resin
Polyester Resins

It's Good For . . .

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Avoiding distortion of ordinary galvanizing . . . 199
Improving properties of paper products . . . 199
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Eliminating need for heat in making petroleum gel . . . 199
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Stimulating plant growth . . . 200
Potential applications as insecticides, fungicides . . . 200
Applications needing stability, low surface tension . . . 200
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Pharmaceuticals because of its high purity . . . 206
Plasticizers . . . 206
Drying in two to four hours . . . 206
Operations involving adsorption of basic materials . . . 206
Combination with glass fiber . . . 206

See Page . . .

dicate that sulphate ions improve rather than impair the performance of the resin. Similarly, Uformite 711 is not sensitive to the presence of residual bleaching agents—an important factor where free chlorine may be used as slime-control agent.

Although Uformite 711 can be added at any point from head box to beater, optimum results are obtained where the resin is added close to the point of sheet formation. Alum, hydrochloric or sulphuric acid can be used for pH adjustment. In normal papermaking operations, sufficient acid should be used to obtain a pH of 4.5 to 5.0, which is the optimum operating range.

The amount of Uformite 711 which should be added to the pulp depends upon the degree of wet strength desired and actual papermaking conditions. In general, the quantity of resin used varies between 0.25 and 3.0 percent resin solids on bone-dry pulp.

As an aging period, varying from 7 to 14 days, is required to develop full wet strength, fresh broke can be repulped readily in conventional equipment.—*Rohm & Haas Co.*, Dept. RG, Washington Sq., Philadelphia 5, Pa.

Steam Cleaning Compound

For reactive metals and painted surfaces.

A new liquid steam cleaning compound, Turco 3232, has been developed and is said to be safe for reactive metals, painted surfaces.

Readily soluble and free rinsing, it will remove light to medium soil deposits without leaving white streaks or solution residues. The compound is stable and will not settle out, and gives scale-free operation except in very hard water.

Non-flammable, it emits no disagreeable fumes, and its active, soapless lather gives the operator visual control of compound strength.

It lubricates cheek valves, pumps and coils, lightening the physical effort of cleaning the eliminating non-mechanically caused steam gun kick and sputter.

Turco 3232 meets corrosion requirements of Air Force Specification 14128a as non-corrosive to aluminum alloys, anodizing and reactive metals. It has been tested and approved for use by Air Materiel Command, Wright Field.—*Turco Products, Inc.*, Dept. C-95, 832 East 62nd St., Los Angeles 1, Calif.

Gel Promotor

Substitutes for heat in the production of gel structures in petroleum products.

Now aluminum octoate gel structures can be formed in many petroleum products without danger of an open fire. New Raybo 77-AiGel is said to completely eliminate the need for heat.

With Raybo 77 gel structures can be formed with several petroleum fractions that will not gel even with heat. For example, the product is said to work with mineral spirits, naphtha, paraffin oil, mineral seal oil, spindle oil, heavy paraffin oil, lubricating and petroleum resinous oil. Only 3 percent Raybo 77 will cause gel formation.

Aluminum octoate gel is suggested for use as a suspending agent for paints, a viscosity producer for paints, oils, paint and varnish removers, a flow retarder. It also reduces penetration of film on porous surfaces.—*Raybo Chemical Co.*, 1120 Chester Ave., Cleveland, Ohio.

Salt-Free Sulphonates

Contamination is less than 0.1 percent thanks to new process.

The first two of a proposed line of special products based on salt-free sulphonates are being turned out by an economical new process. They are Ninex 21, a foam-stabilized liquid detergent, and Toximul, an anionic agricultural emulsifier.

Products to come include nonfoaming detergents, all-purpose emulsifiers and lube oil additives. Their lack of salt will give them better solubility in either water or oil and greater stability in formulations such as cosmetic emulsions.

Unique feature of the new process is the use of liquefied sulphur trioxide as a sulphonating agent in place of the conventional oleum. Using standard sulphonating methods, salt contamination cannot be cut to less than 15 percent. The new sulphur trioxide method yields products with under 0.1 percent salts.

A new plant now under construction in Chicago will have a projected capacity of about 10 million pounds. —Ninol Laboratories, 1719 South Clinton St., Chicago 16, Ill.

Organic Silicofluorides

Brand new series of chemicals for the commercial world.

It's too early to say much about uses of organic silicofluorides. But it looks as though they have potentialities as insecticides, fungicides, mildewcides, mothproofing agents and rubber accelerators.

The six now available are:

1. Methylamine silicofluoride — white crystalline solid with a slight amine odor, slightly hygroscopic, stable to hydrolysis at elevated temperatures.

2. Dibutylamine silicofluoride — white crystalline odorless flakes, non-hygroscopic, stable to hydrolysis at elevated temperatures.

3. Ethylhexylamine silicofluoride — Odorless, almost colorless, wax-like solid, nonhygroscopic, slightly soluble in benzene and Cellosolve, very soluble in ethyl alcohol, Stoddard's solvent, perchlorethylene, methyl alcohol, isopropyl alcohol, n-butyl alcohol, carbon tetrachloride.

4. Aniline silicofluoride — light tan



CORN SPRINKLED WITH TERRAMYCIN IN WATER GROWS TALLER

Seeds planted in lefthand box were watered for four days with mixture containing five parts terramycin per million parts water. Researchers state that antibiotic not only stimulated growth but also increased percentage seed germination. Chas. Pfizer & Co., Brooklyn, N. Y.

crystalline solid with slight odor, non-hygroscopic, sublimates at 230 deg. C.

5. Rosin amine silicofluoride — light tan crystalline solid with a slight odor, nonhygroscopic, insoluble in water and ethyl alcohol.

6. Morpholine fluosilicate — white crystalline solid with a slight odor, slightly hygroscopic, stable to hydrolysis at elevated temperatures.

Samples (4 oz.) are available immediately; development quantities are available within 30 to 90 days. —Davison Chemical Corp., Baltimore 3, Md.

Wetting Agent

A fluorocarbon, it offers lower surface tensions than any other type of wetting agent.

Now produced in pilot plant quantities by electrochemical fluorination is wetting agent F-126. It is a mixture of ammonium salts of completely fluorinated carboxylic acids, chiefly perfluorocaproic acid.

Fluorochemical wetting agents will find major use in those applications where stability, very low surface tension, non-sudsing detergency, or some other unique property of this class of materials is needed. For example, the stability of F-126 in hot acid solutions may make it useful in metal cleaning and plating operations. Though it loses ammonia in hot alkaline solutions, F-126 retains its surface activity

and may be useful in degreasing baths.

The very rapid penetrating action of solutions of F-126 suggest that it may be used to advantage in processing heavy textiles, leather or similar very dense, compacted materials.

Specialized cleaning and wetting applications are suggested by the unique behavior of F-126 in dirt removal without redeposition and without emulsification of oily constituents. For example, the addition of small amounts of F-126 to drilling muds may increase the efficiency of oil well operations; or F-126 may be useful in increasing the effectiveness of acid treatments for the revivification of old oil wells.

The structure of F-126 suggests its application in polymerization processes where fluorine containing monomers are involved. F-126 has a limited effectiveness with hydrocarbon monomers. For instance, styrene is readily polymerized in emulsions containing F-126 to form smooth, stable latices. Acrylonitrile, on the other hand, coagulates as it polymerizes in emulsion systems containing F-126.

Because of the extremely low surface tension of aqueous solutions of F-126, foams can be produced with relatively little energy. This suggests the use of F-126 in the preparation of foams. These foams would not be stable, a situation which might be desirable in the production of foam rubber and porous plastics. Where a stable foam is required, the addition



"Sweet solution" to a filtration bottleneck

Gearing sugar production to meet ever-increasing demands is a problem that the sugar industry actually solved years ago when they eliminated filtration bottlenecks by starting to use Celite* filter powders.

Sugar refiners found that pressure filtration, using Celite, completely removed colloidal matter at high flow rates for long, uninterrupted cycles.

Celite's ability to do an exceptional filtering job can be attributed to these

important factors which make it unique among filter aids:

Carefully processed from the purest deposit of diatomaceous silica known, Celite is available in nine standard grades—each designed to trap out suspended impurities of a given size and type. Whenever you reorder, you are assured of the same uniform, accurately graded powder received in your initial order. Thus, with Celite, you can count on consistent clarity in your

filtrates—at highest rate of flow—month after month, year after year.

Helping sugar producers to get faster production is just one way in which Celite has improved operations for many industries. The proper grade of Johns-Manville filter aid will assure you the same results. To have a Celite Filtration Engineer study your problem and offer recommendations, simply write Johns-Manville, Box 290, New York 16, N.Y. *No cost or obligation.*

*Reg. U. S. Pat. Off.



Johns-Manville CELITE

FILTER AIDS

NEW PACKAGED carbon dioxide FIRE EXTINGUISHING SYSTEM inexpensive . . . simple . . . sure!

Do you want maximum fire-fighting power at minimum cost? Then you want the new *Kidde* Standard Pak. It's an inexpensive ready-made system you can build in for protection against tough fires in normal flammable liquid hazards.

Anyone who can cut pipe can set up this pre-engineered fire extinguishing "package." Choose from six sizes for volumes up to 6,000 cubic feet.

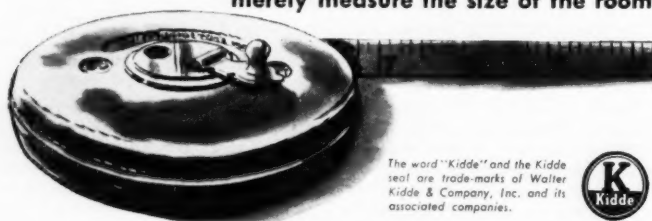
Every kit contains *Kidde* rate-of-temperature-rise heat detectors, *Kidde* Multijet nozzles, and automatic discharge heads. Pipe and fittings are optional, as are pressure trips and switches, remote controls, sirens, gongs

pre-engineered

any pipefitter
can install it



merely measure the size of the room



The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc. and its associated companies.



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Send today
for further
details on
The New Kidde
Packaged Fire
Extinguishing
System.

PRODUCT NEWS, cont. . .

of a stabilizer such as saponin is suggested.—*Minnesota Mining & Mfg. Co.*, 900 Fauquier Ave., St. Paul 6, Minn.



Dispersion Agent

Controls sagging and running in finished paints, see treated test plate, right.

An oil-soluble wetting agent introduced early this year has a newly-discovered property that should hit the paint industry right where it sags. Griffin Chemical Co., San Francisco, has discovered that its Tenlo 70, a non-ionic modified polyamine and polyhydric alcohol ester originally developed to aid in pigment mixing and grinding, will also reduce sagging and running when added to finished paints. Its action is particularly apparent in high and semi-gloss enamels where sag tendencies are greatest.

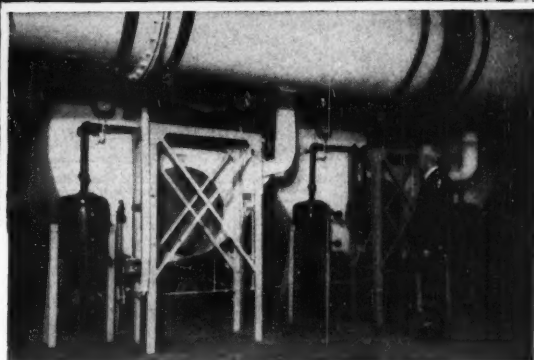
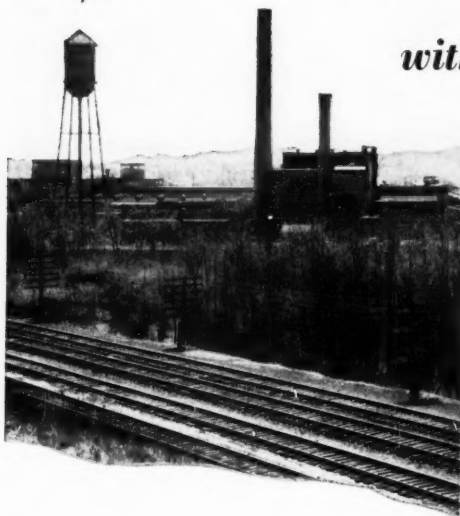
In the last two months over 50 samples of nationally advertised enamels purchased from dealers shelves have been subjected to a severe standardized draw-down sag test. Tenlo 70 was added in the proportion of 7 lb. per 100 gal; untreated samples were retained as blanks. After allowing samples to age over-night, a Bird applicator was used to lay 3 mil. (0.003 in.) wet films on plate glass. A rubber eraser was drawn across the film in a zig zag line and the plate placed in a vertical position to dry. Any sagging and running showed up clearly in the valleys of the wavy lines. (See cut).

Tenlo 70 is not the only material that can be added to finished paints to control sagging. Paint companies have long used soap solutions or protein-type materials such as soya lecithin to turn the trick. Tenlo 70, however, does a better job (in the test

95% of Gasoline Solvent Recovered

with **COLUMBIA** Activated Carbon

Trade-Mark



WRITE FOR BOOKLET

Send for our 16-page booklet "How 7 Industries Save \$150,000,000 a year with COLUMBIA Activated Carbon" which tells how other companies have profited. A request on your letterhead will bring you a copy, without obligation. Write today.

CARBIDE AND CARBON CHEMICALS COMPANY

A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street **UCC** New York 17, N. Y.

COLUMBIA

Activated
Carbon

SOLVENT RECOVERY • CATALYSIS
GAS AND AIR PURIFICATION

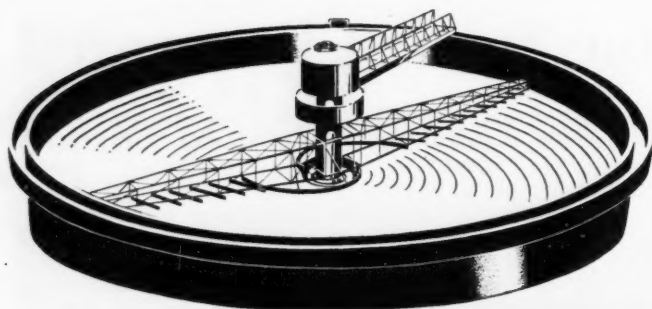
A modern solvent recovery plant for The Garlock Packing Company, Palmyra, New York, using COLUMBIA Activated Carbon as the adsorbent, collects about 1,000 pounds of gasoline vapor per hour from the air and delivers it ready for re-use. The gasoline is vaporized during the manufacture of asbestos sheet packing and is recovered at lower cost and higher efficiency than is possible with any other commercial method. Operating records for a 10-month period since the plant started show an *overall* recovery efficiency of 95.9 per cent. In addition to the profitable recovery of gasoline, this installation also:

- improves the working conditions in the plant,
- helps reduce the hazards of handling gasoline vapors,
- avoids the discharge of large volumes of solvent-laden air into the atmosphere.

The special features of CARBIDE's automatic equipment and the high adsorptive capacity of COLUMBIA Activated Carbon make such performance possible for Garlock Packing.

If you vaporize solvents in your process, let CARBIDE help you conserve valuable solvents, improve processing conditions, and clean up exhaust air. We can supply you with a complete, automatic, instrument-controlled plant designed for your specific requirements with guaranteed operating efficiency to recover solvent vapors or purify industrial gases.

"Columbia" is a registered trade-mark of Union Carbide and Carbon Corporation

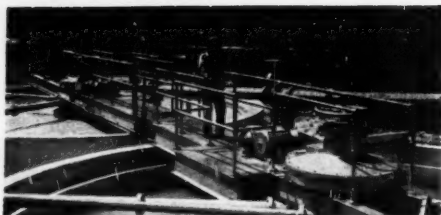


**HARDINGE
CLARIFIERS
or
THICKENERS**
may
solve your
WASTE-WATER
problems

Hardinge has installed waste water treating or reclaiming equipment for the following industrial operations:

COAL
PAPER
OIL
GLASS
LIME
STONE
SAND
FLUE-DUST
CARBON BLACK
MEAT PACKING
RUBBER
DOMESTIC
SEWAGE

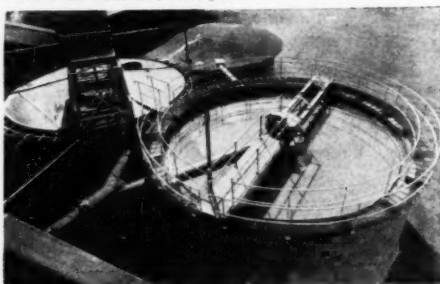
Write for
Bulletin
31-D-11



LIME—two 32'-diameter by 15'-deep Hardinge Thickeners reclaiming calcium carbonate for lime production from clarifier underflow in a water-treating plant.



FLUE DUST—A 110'-diameter, centerpier Hardinge Clarifier recovering 50 tons per day of usable solids from blast furnace flue wash water in a steel plant.



PAPER—30'-diameter Hardinge Thickener recovering 2 to 2½ lbs. of fiber and filler per 1,000 gallons of paper plant waste water.

H A R D I N G E
C O M P A N Y , I N C O R P O R A T E D

YORK, PENNSYLVANIA—240 Arch St. Main Office and Works
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122 E. 42nd St. 24 California St. 205 W. Wacker Dr. 2016 First Ave. 200 Bay St.

PRODUCT NEWS, cont. . .

described above it reduced sagging and running in enamels supposedly either specifically formulated for low sag or already treated with conventional sag-reducers), and it is the only mixing and grinding aid known to have sag-reducing properties.

Furthermore, it has the advantage of being completely inert in regard to other paint characteristics; will not affect gloss, viscosity, brushability, dry, color or can stability. It works uniformly on most paints and enamels, requires no reformulation.

Other applications of Tenlo 70: in production of putty, printing inks, linoleum, and in polyester impregnation of fiberglass—wherever non-aqueous systems require a wetting agent.

Griffin recommends that Tenlo 70 be added in the initial mix or grind to take advantage of its rapid wetting out properties as well as further enhancing its anti-sag properties. Used thus, 3-7 lb of Tenlo 70 per 100 gal can reduce most cases of excessive sagging and running to the minimum consistent with good flow-out characteristics, reduce grinding times as much as 50 percent, retard hard settling, and will also overcome silking and flooding.

The cost of Tenlo 70 will be negligible and probably would not appear in the retail price of the finished paint. Paint manufacturers should be able to absorb the cost through savings in grinding power requirements, production times and increased customer acceptance.

Sagging and running is an immediate and long standing problem throughout the paint industry. It is understood that Federal paint specification TT-P 141-b and other paint specifications which have not included definite sag-test requirements have under consideration a standardized sag-test along the lines of current industry testing methods.

The importance of non-sagging properties in high flow paint products to paint contractors interested in job time and quality should speed national acceptance of Tenlo 70 for this property alone. And of course this will also be a boon to the amateur painter, who lacks the experience necessary for skillful application of high flow, quick drying paints. Present price is 49¢ per lb. in 55 gal drums.—Griffin Chemical Co., 1000 16th St., San Francisco, Calif.

Turbo-Topics



**TURBO-MIXER, A DIVISION OF
GENERAL AMERICAN TRANSPORTATION CORPORATION**

Engineering Responsibility

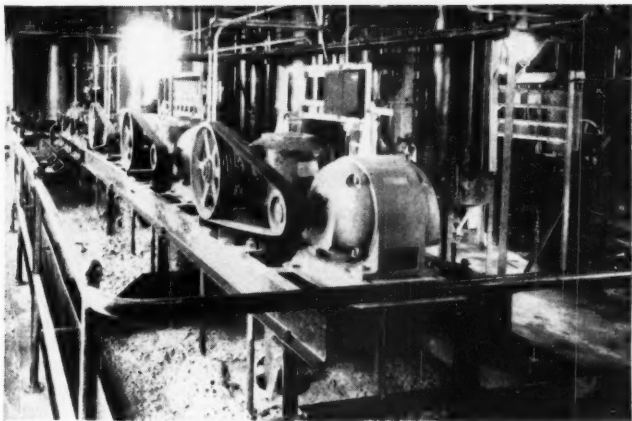
The entire Turbo-Mixer sales staff is composed of trained and experienced mixer engineers. These Turbo-Mixer engineers are the men who call on you. They are qualified to discuss every aspect of your mixing problem and the appropriate mixer design, including construction, operation

and availability.

These same engineers check your order, review final drawings, and follow through to successful operation in your plant.

Such "Engineering Responsibility" assures you of reliable installations and maximum engineering service.

Turbo-Mixer



Series of Turbo Aerators and Floaters on phenolic waste treatment

SALES OFFICE: 10 EAST 49th STREET, NEW YORK 17, NEW YORK

General Offices: 135 South La Salle Street, Chicago 90, Illinois

• Offices in all principal cities

**OTHER GENERAL AMERICAN EQUIPMENT:— DRYERS • EVAPORATORS • DEWATERERS
TOWERS • TANKS • BINS • FILTERS • PRESSURE VESSELS**

PROBLEM:

To provide a drying system that would increase the output of titanium dioxide without sacrifice in the quality of the finished product.

SOLUTION:

Proctor engineers recommended a Proctor continuous conveyor drying system with a rolling extruder feed. Preforming permits air to circulate all the way through the bed of material on the constantly moving conveyor. Production has been materially increased. All other factors affecting drying are carefully regulated for accurate control of product quality.

Another processing problem solved by

PROCTOR

INTEGRATED ENGINEERING

This processing problem was solved only by painstaking research. Exhaustive test work done in the Proctor laboratory, in cooperation with the customer's technicians, netted conclusive results that were projected into full scale operation. So accurate was this work that the performance of the drying system was guaranteed in the sales contract and the dryer was designed to dovetail right into the complete processing line. This approach to a processing problem is INTEGRATED ENGINEERING AT WORK!

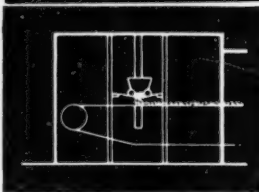
By INTEGRATED ENGINEERING
we mean simply this—

1. Sales engineers are available for consultation.
2. A completely equipped experimental laboratory is available for test work at no cost or obligation.
3. Engineering background and experience in drying equipment and its relation to associated processing equipment in the range.
4. Close cooperation between Proctor engineers and the customer's technicians to bring about the solution to processing problems.

NOW PROCTOR IS PREPARED
TO ENGINEER AND MANUFACTURE
RELATED EQUIPMENT

With their long background in designing and building precision drying machinery, Proctor engineers have acquired a wide knowledge of processing equipment requirements... so that today Proctor & Schwartz actually offers a complete engineering-manufacturing facility ready to help you consider not only your drying equipment needs—but a complete range of related processing equipment.

What is your processing machinery problem? Let Proctor INTEGRATED ENGINEERING help speed your solution.



**PROCTOR &
SCHWARTZ
· INC. ·**

711 TABOR ROAD
Philadelphia 20, Pa.



PRODUCT NEWS, cont. . .

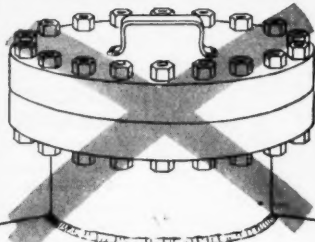
Synthetic amyl acetate is now being produced in a new grade for the pharmaceutical industry. The new product contains a minimum of 92 percent amyl acetate and will be known as Pent-Acetate 29.—Sharpley Chemicals Inc., 123 South Broad St., Philadelphia 9, Pa.

Two decyl diesters are now on the market as plasticizers. They are: di-decyl adipate, called Cabflex DDA; di-decyl phthalate, called Cabflex DDP. They are said to offer far lower volatility and permanence in vinyl compounds than is obtainable from presently available octyl phthalates, yet they retain similar low temperature properties. These will be competitively priced.—Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass.

Pigmented primer is formulated on a synthetic resin base, not a water latex emulsion. One coat is said to prime, seal and cover and to dry in two to four hours.—Tropical Paint & Oil Co., Cleveland 2, Ohio.

An analytical grade of cation exchange resin, Amberlite IR-112(H), is now available. The new resin, which is a highly purified form of the recently announced IR-112 exchanger, can be used to advantage in operations involving adsorption of basic materials from both aqueous and nonaqueous solutions, recovery of metallic complexes, extraction of large cations, and catalysis of organic reactions.—Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.

Polyester resins which Naugatuck Chemical Division has been producing under the trade name Vibrin, will soon be coming out of the company's increased facilities in Naugatuck, Conn., in increased quantities. Demands for the resin as a structural material in combination with glass fiber have increased steadily during the past 12 months. Areas of greatest expansion have been shown in the use of the material for the manufacture of chemical-resistant pipe, translucent and transparent sheet, construction materials, machine housing, materials handling equipment.—Naugatuck Chemical Division, Rockefeller Center, New York 20, N. Y.



**Save the cost of a
man-hole and additional
tank openings...**

Utilize a

BS&B

MODEL
VVH

**Pressure-Vacuum Vent Valve
DOES DOUBLE DUTY**

**1. Replaces
a man-hole
cover**



Big enough to admit

**2. Gives
pressure-
vacuum
protection**

even this 200 pounder

Spare no materials and expense to make the equipment do the job for which it's needed and intended . . . This is the code of BS&B engineers.

On the other hand, they're very conscious of saving the customer money wherever they can. A perfect example is the BS&B Model VVH-Pressure-Vacuum Vent Valve in the 20" and 24" sizes. It does double duty by eliminating a man-hole on your tank deck and provides relief against excessive pressure and vacuum.

The Model VVH is used as a secondary relieving device on atmospheric storage tanks containing flammable materials . . . or as a primary relief device on tanks where non-flammable material is involved.

Reduce Your Maintenance Costs

The BS&B Model VVH-Pressure-Vacuum Vent Valve permits easy access to inside of your tank . . . just lift the valve bonnet . . . no need to disengage the bonnet from the valve body. No man-hole cover to fall off and damage equipment or injure personnel, no bolts to get lost; minimum of moving parts! Write for BS&B Bulletin No. E-601 giving complete information.

SIZES AND MINIMUM-MAXIMUM PRESSURE SETTINGS

Valve Size	Opening Pressure	Vacuum Opening	Maximum Opening Pressure
Inches	Ozs.	Ozs.	Ozs.
2	2.0	0.5	16
3	2.0	0.5	16
4	1.75	0.5	16
6	1.75	0.5	16
8	1.75	0.5	16
10	1.75	0.5	16
12	1.75	0.5	10
16	2.0	0.5	8
20	2.0	0.5	6
24	1.5	0.5	4

NOTE: Internal setting can be reduced to 0.5 oz. by inserting a counter weight to valve bonnet.

Standard *Material Specifications

Bonnet: Cast aluminum
Body: Cast iron
Retaining ring: Cast aluminum
Vacuum ring: Steel
Retaining ring spring: Steel
Plug: Synthetic rubber (Buna-N)
Flange drilling: 150 # ASA

*Any component part of the valve assembly can be constructed of materials resistant to your tank vapors.

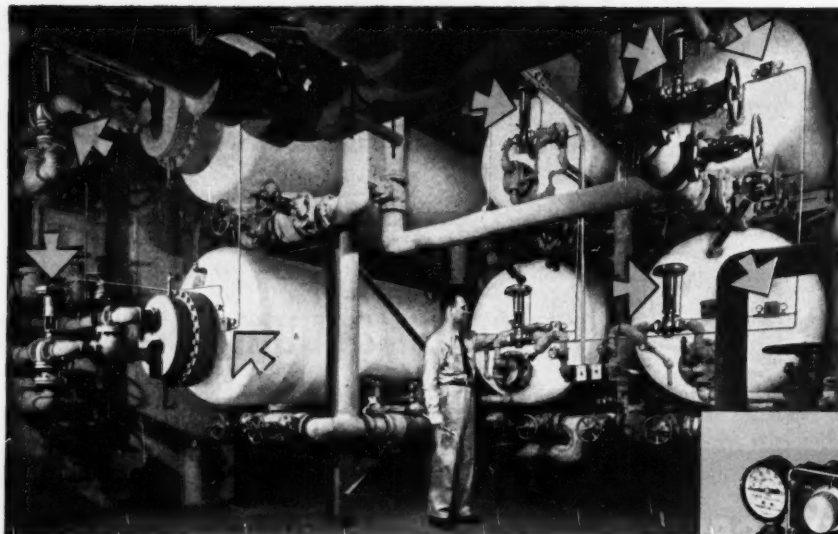


BLACK, SIVALLS & BRYSON, INC.

7500 East 12th Street

Kansas City 3, Missouri

Safety Head Division - Dept. 2-N10



Chief Engineer Edward MacDonald states "Performance of Powers Accritem Temperature Regulators has been highly satisfactory on the 6 water heaters shown above as well as on booster heater for dishwasher and for controlling cooling of condensate before discharge to sewer."

WATER HEATERS AT LEVER HOUSE New York City

Architects: Skidmore,
Owings & Merrill
Consulting Engineers:
Jaros, Baum & Bolles
Contractor: Gillman-
Rous-Pesce Corp.



One of
Lever Brothers Co.
Famous Soaps



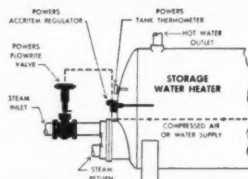
Powers ACCRITEM Regulator
Compressed Air or Water Operated

POWERS WATER TEMPERATURE CONTROL

ACCRITEM Regulators were selected for **LEVER BROTHERS** beautiful modern building on Park Avenue in New York City. The air conditioning system here is also Powers controlled.

Water heaters in more and more prominent buildings are being equipped with Powers Accritem Regulators because of their —

Unsurpassed for reliability and power to operate large or small diaphragm valves controlling Water Heaters, Heat Exchangers, Jacket Water Cooling for Diesel Engines or Air Compressors and many Industrial Processes.



**POWERS
3-Way
FLOWRITE
Water Mixing
VALVE**
Used on two
heaters above

Important Features that Give Better Control and Lower Maintenance

- **Adjustable Sensitivity** and over-heat protection.
- **Calibrated Dial** temperature adjustment.
- **Simple, Rugged Construction** withstands vibration and insures years of reliable service.
- **Temperature Ranges** 50-250° F. and 150-350° F.
- **Easy to Install.** Requires 15 lb. supply of compressed air or water for its operation.
- **Small Size**—regulator head is only 2 7/8" x 3 3/8", sensitive bulb is 12" long with 1/2" I. P. S. connection.

Bulletin 316 gives full details

Call Powers for aid with your problems of temperature control. Our more than 60 years of experience may be helpful to you. Whether you want a simple self-operated regulator or thermostatic water mixing valve or a pneumatic control system with recording controllers...contact Powers.



**POWERS
Single Seat
FLOWRITE
VALVE**
Used on
4 heaters
above

THE POWERS REGULATOR COMPANY

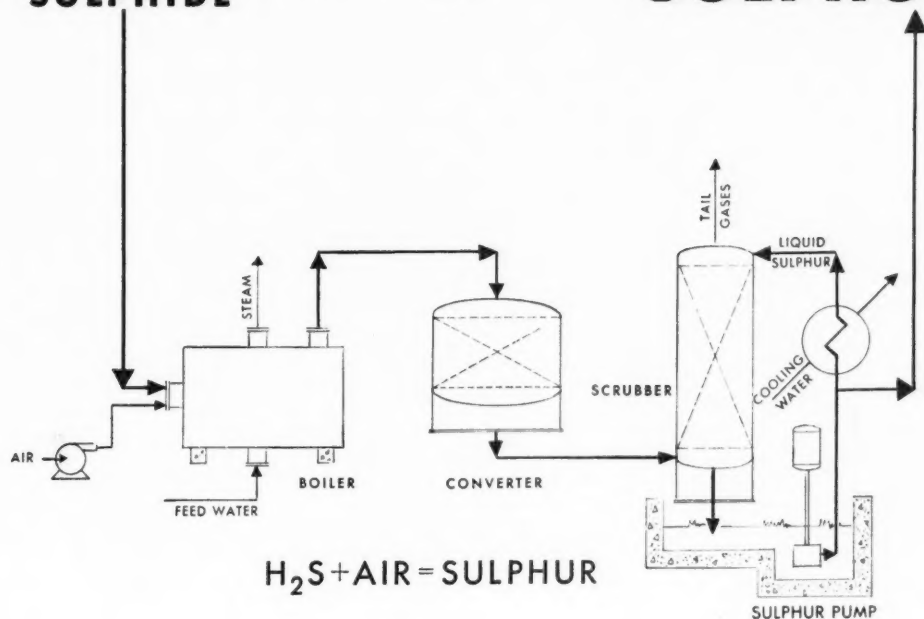
Skokie, Ill. • Offices in Over 50 Cities, See your phone book • Established 1891

(a91)

**HYDROGEN
SULPHIDE**

.....TO.....

SULPHUR



...a one-man operation with GIRDLER plant

ONE MAN can operate the average Girdler continuous-flow Sulphur Plant. Instruments control the process, which is practically automatic.

The basic process material—hydrogen sulphide—can be removed easily from sour refinery gas, natural gas, or liquid hydrocarbons by a Girdler Girbotol Plant.

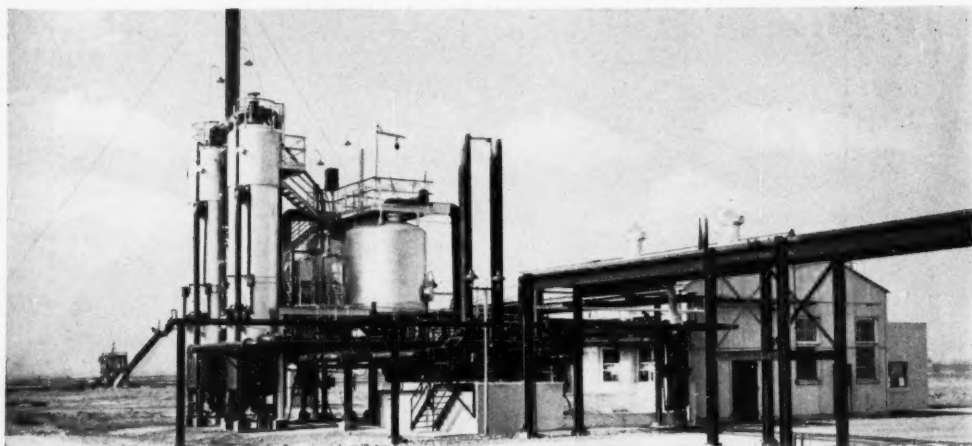
Up to 95% of the sulphur present as hydrogen sulphide can be recovered with a two-stage plant. A single-stage plant recovers up to 85% of the sulphur.

Write for complete information. The Girdler Corporation, Gas Processes Division, Louisville 1, Kentucky.

SULPHUR IS SCARCE! ARE YOU THROWING IT AWAY?

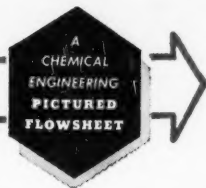
If you remove hydrogen sulphide from gaseous or liquid hydrocarbons, you should consider converting it into a valuable by-product. The acid gas stream from a Girbotol purification plant is usually an ideal feed material for sulphur production.

The **GIRDLER** *Corporation*
Gas Processes Division



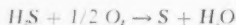
General view of Freeport Sulphur Co.'s sulphur recovery plant near Westville, N. J.

Sulphur From H_2S



Freeport Sulphur Co. is solving two problems with its sulphur recovery plant near Westville, N. J. where it not only recovers up to 30 long tons per day of scarce elemental sulphur but also eliminates a source of atmospheric pollution by employing as the raw material waste hydrogen sulphide gases from Texas Co.'s nearby Eagle Point refinery. This plant, engineered and constructed by The Girdler Corp., Louisville, Ky. has been in successful and essentially continuous operation since Jan., 1950. It is typical of the many similar units that have recently sprung up across the country to help meet the increasing demand for this basic chemical commodity.

The Freeport plant employs a modification of the original Claus process for carrying out the highly exothermic reaction:



In order to remove the heat generated more efficiently and to maintain better control over the process the above reaction is carried out in two steps as follows:

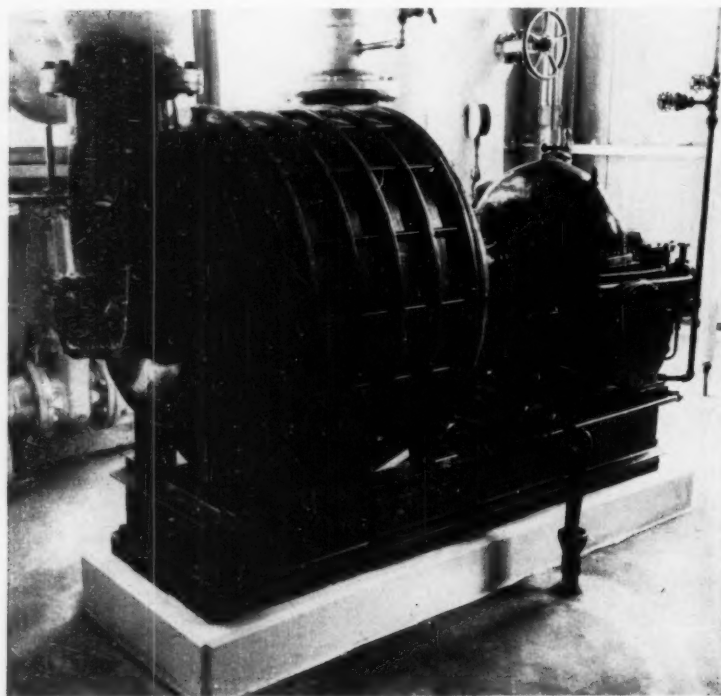
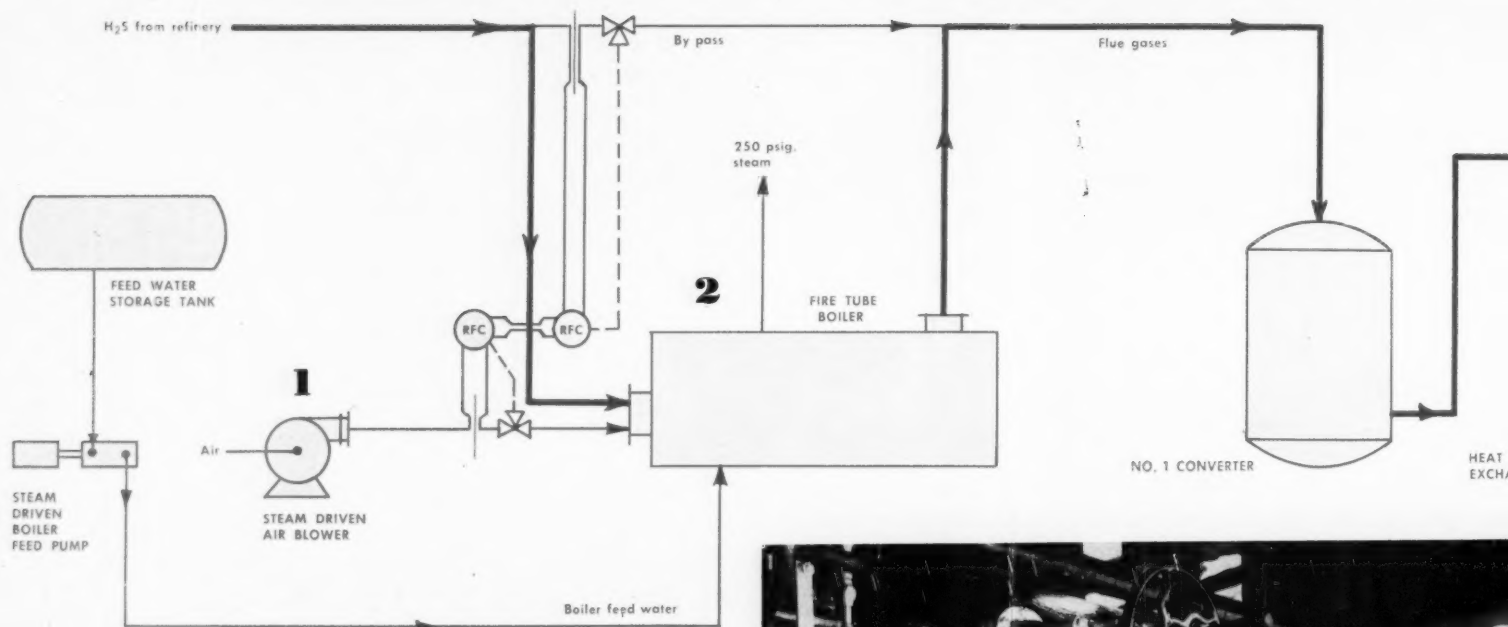


Reaction (1) takes place in the combustion chamber of a modified packaged type fire tube boiler which has been specially adapted to the process. One-third of the hydrogen sulphide gas is burned to sulphur dioxide in this boiler and the remainder may be by-passed around the boiler or introduced along with the portion burned. Approximately 2 1/2 lb. of steam may be produced per pound of sulphur recovered. This steam can be used simultaneously to drive the air blowers, boiler feedwater pumps and a spare sulphur pump.

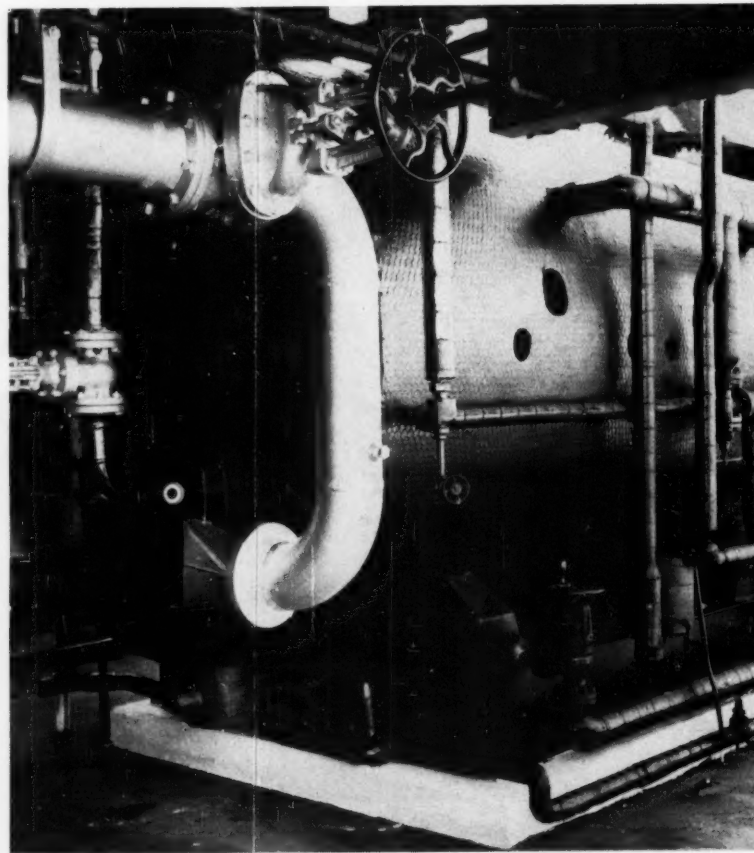
Following the steam boiler the gases pass through the first converter where most of reaction (2) takes place and a gas temperature rise results. It is estimated that 70-80 percent of the sulphur recovered is formed prior to and in the first stage and the balance in the second after intermediate product removal. 90 to 95 percent of the H_2S is recovered as sulphur. The converters are carbon steel vessels lined with a suitable sulphur resistant cement, and packed with a bauxite catalyst.

In order to remove the sulphur formed in the first converter the gases are cooled to approximately 300 deg. F. and the sulphur condensed in the first of two identical scrubbers. A heat exchanger is employed to cool the gases entering this scrubber and reheat them before entering the second converter. A direct fired reheater employing a side stream of hydrogen sulphide for fuel is installed just upstream from the second converter, and may be used instead of the heat exchanger if desired. Freeport uses this reheater for start-up purposes only, as the heat exchanger is more economical to operate. Cooling and condensation after each converter takes place in carbon steel, Raschig ring packed scrubbers, where the hot gases pass counter-current to liquid sulphur. The heat absorbed by the liquid sulphur during the scrubbing operation is removed by cooling before it is returned to the sulphur tank with the newly formed sulphur. The tail gases largely consist of nitrogen, water vapor, and carbon dioxide.

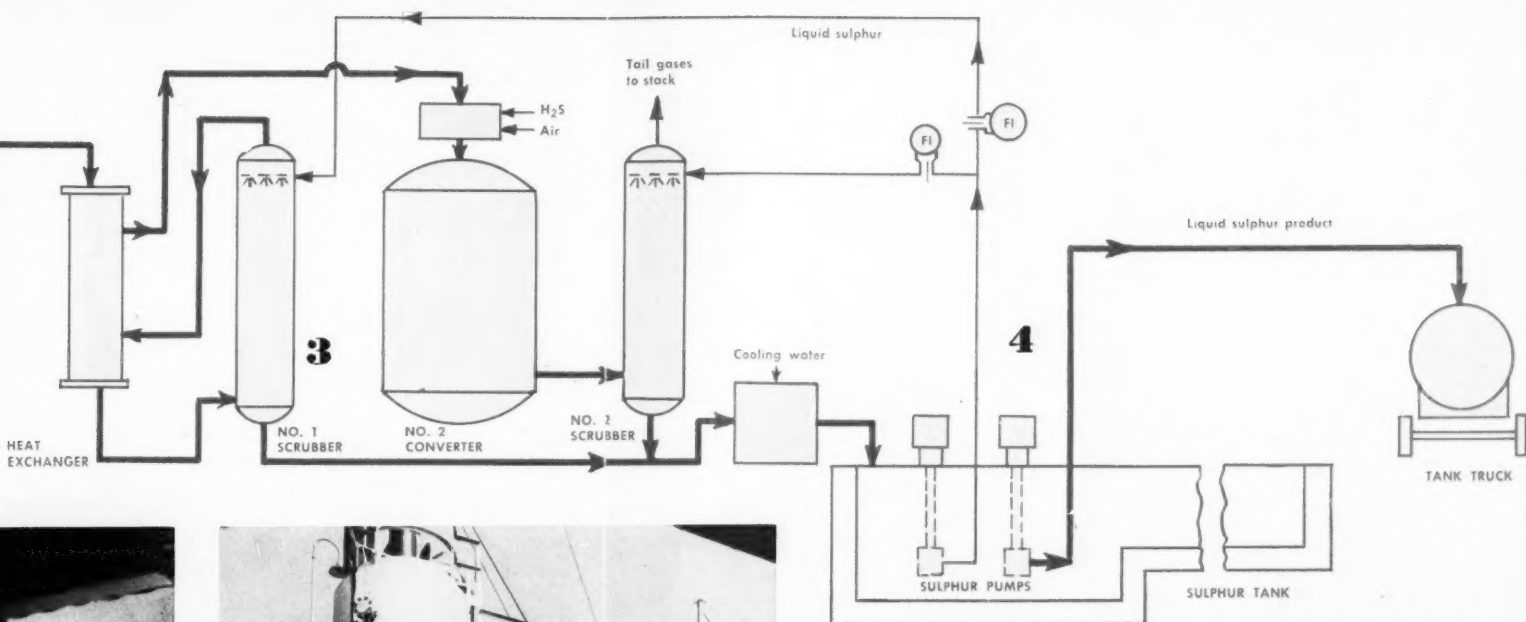
Principal controls required for this plant are gas and liquid flow instruments and temperature and pressure recorders. The plant is completely automatic when the hydrogen sulphide content of the feed gas is essentially constant. Periodic analyses of this gas and the tail gas are sufficient for plant control purposes.



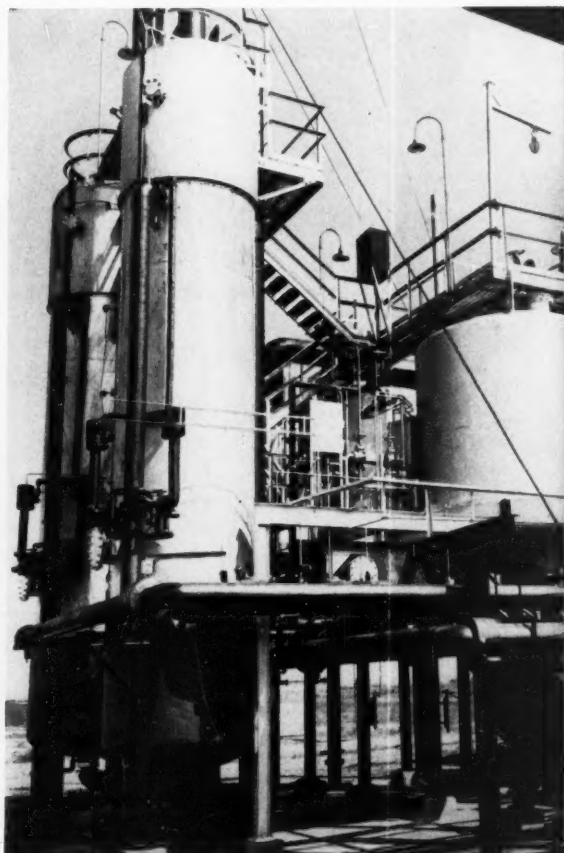
1 Steam-driven air blower provides air for combustion of the hydrogen sulphide. Steam to drive the blowers is taken from the fire tube boiler.



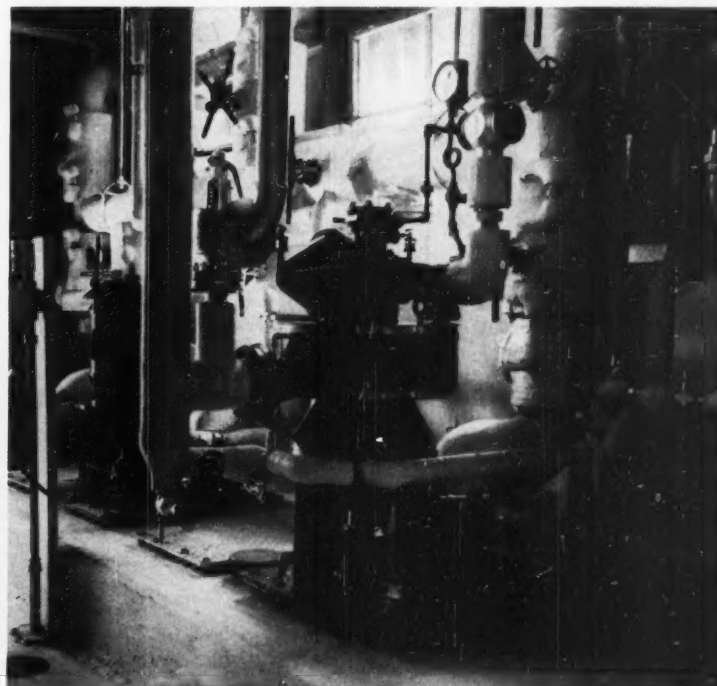
2 Modified packaged type fire tube boiler. In the combustion chamber of this boiler, one-third of the hydrogen sulphide is burned to sulphur dioxide. Remainder of the hydrogen sulphide is bypassed.



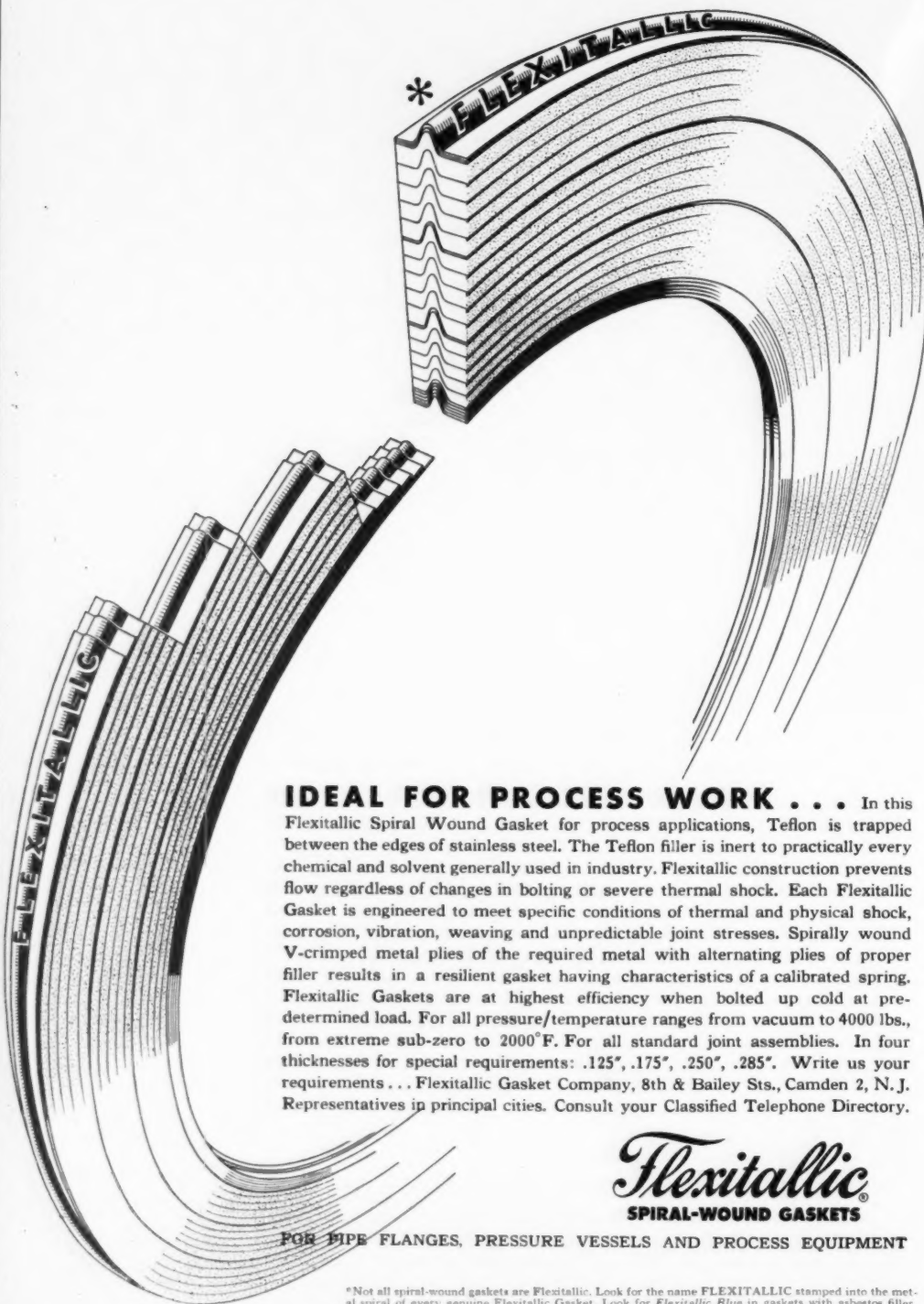
of the hydrogen sul-



3 Converters in which hydrogen sulphide reacts with sulphur dioxide to form sulphur are at right. Scrubbers are at left in this picture.



4 Vertically-mounted sulphur pumps. Right-hand pump is steam driven, other two electric. These pumps deliver sulphur to tank truck and to scrubbers.



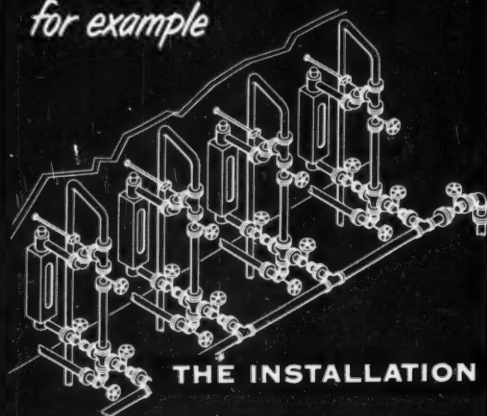
IDEAL FOR PROCESS WORK . . . In this Flexitallic Spiral Wound Gasket for process applications, Teflon is trapped between the edges of stainless steel. The Teflon filler is inert to practically every chemical and solvent generally used in industry. Flexitallic construction prevents flow regardless of changes in bolting or severe thermal shock. Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-cripped metal plies of the required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at predetermined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". Write us your requirements . . . Flexitallic Gasket Company, 8th & Bailey Sts., Camden 2, N. J. Representatives in principal cities. Consult your Classified Telephone Directory.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for Flexitallic Blue in gaskets with asbestos filler

**Are You Getting
from Your Valves?**
...on Bleach Plant Piping
for example



Crane valves on chlorine rotameter control board in pulp stock bleach plant of The Northwest Paper Co., Cloquet, Minn.

THE HISTORY

Tough and destructive as is chlorine service on valves, this plant is enjoying greater freedom from valve trouble than ever before. Since installing Crane Chlorine Valves, more than 4 years ago, the plant finds them "the best we have ever used."

Operating at pressures from 70 to 100 psi, at 110 degrees F., these Crane valves have required but minimum maintenance and servicing. They have helped make important savings in chlorine valve costs. The customer reports 3-way satisfaction with Crane Chlorine Valves: their good performance; their low cost of maintenance; and their continual ease of operation.

The Complete Crane Line Meets All Valve Needs. That's Why
More Crane Valves Are Used Than Any

CRANE VALVE

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUM

CHEMICAL ENGINEERING—October 1952

g Value Like This

VALVE SERVICE RATINGS

CORROSION-RESISTANCE:

Excellent

SUITABILITY:

Designed for Chlorine service

MAINTENANCE COST:

Low - Routine only

SERVICE LIFE:

Now more than 4 years

OPERATING RESULTS:

Better, safer chlorine control

PRICE:

*Lowest cost
in terms of service given*

AVAILABILITY:

Stock item in Crane line

THE VALVE

Strong yet compact, Crane No. 1644 Forged Steel Valves are recommended for chlorine gas or liquid, free from water, at temperatures up to 300 deg. F. Disc and seat ring are Hastelloy "C"; stem is Monel. Hard deposits do not hinder this narrow-bearing, tight-seating design. Bonnet joint remains leakproof with corrugated soft Monel gasket. Globe and angle patterns. See your Crane Catalog or Crane Representative.



by
n Any Other Make!

VALVES

Chicago 5, Illinois
Areas

UMBING • HEATING

215

What types of materials
can be **FLASH DRIED?**

FLASH DRYING AND PULVERIZING

CLAYS

CHEMICALS

PIGMENTS

FOOD
PRODUCTS

FLASH DRYING WITH DISINTEGRATION

STARCH

CORN GLUTEN

SILICA GEL

PRECIPITATED
CALCIUM
CARBONATE



SINCE 1887

RAYMOND
Flash Drying
CATALOG No. 54A

A wide variety of filter cakes, as well as centrifuged and natural materials, can be handled by Flash Drying Methods.

These Flash Drying Systems have unusual flexibility in application, since they can be used with different types of Raymond Mills, and the equipment arranged to handle your particular product.

In the case of a great many solid materials, both drying and grinding may be necessary, involving the use of the Raymond Roller Mill or the Raymond Imp Mill, depending upon the nature of the product and the moisture content of the raw material.

Another class of products with the ultimate particle size already determined needs only disintegration, combined with drying. This is accomplished effectively with the Raymond Cage Mill System which is adapted for a wide range of moisture removal.

The extraction of combined moisture from hydrate compounds and the safe drying of heat-sensitive materials are typical of the many special applications of Raymond Flash Drying.

By using Flash Drying Methods, you can count on such advantages as ease of installation, low operating costs, high heat efficiencies, shortened production time, close control of particle size and moisture content and, in many cases, a superior finished product.

Why not let Raymond Engineers analyze your drying-and-grinding problem?

COMBUSTION ENGINEERING - SUPERHEATER, INC.
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PULVERIZER DIVISION

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October 1952—CHEMICAL ENGINEERING

Chemical Engineering News



SILVER enters the process in the form of ingots. Kodak uses 12 tons of it a week for photographic chemicals.



CRYSTALS of AgNO_3 are charged to the centrifugal. Special feeder lets mother liquor drain back to the crystallizer.

Kodak Redoubles Silver Nitrate Output

Continuous process, incorporating some smart chemical engineering, saves labor, improves working conditions, ups capacity per unit of space.

So successful has been Eastman Kodak's continuous unit for production of silver nitrate crystals, first put into operation in February 1947, that a second unit is now being installed to double crystal output.

Although this unit is small enough for petroleum or heavy chemical people to think of it as more of a pilot plant, its output—nearly five tons per day, worth about \$70,000—represents a major share of U. S. production of this important fine chemical. Part of the huge Kodak Park works at Rochester, this plant supplies high-purity AgNO_3 for all of Kodak's photographic film, with a fair portion finding its way into external sales.

H. R. McDougal, a staff engineer for the chemical manufacturing division, supervised the development of the continuous process. Equipment was designed and installed by Kodak's own engineering staff.

The process itself is simple enough. It's those little—but important—design details that make it a success.

For example, Types 309 and 310 stainless steel are used throughout.

Although 309 (25 percent Cr, 12 percent Ni) is OK from a corrosion standpoint, 310 (25 percent Cr, 20 percent Ni) is more ductile and is easier to fabricate into tubing.

In the early days, even these alloys weren't always satisfactory; corrosion rates were sometimes erratic, higher than expected. But today alloy producers are putting out more uniform materials. And with Eastman's own shops doing the fabrication, equipment today stands up for years.

► **Process Steps**—In brief, the process consists of these steps:

- Dissolving silver bars in nitric acid to get a 65-percent AgNO_3 solution.
- Evaporating some of the water to raise the concentration to 85 percent.
- Cooling and crystallizing AgNO_3 from the solution.
- Centrifuging and washing the AgNO_3 crystals.
- Redissolving the crystals in hot distilled water, recrystallizing and centrifuging.
- Drying and packaging the pure finished crystals.

For the dissolving step, Kodak uses

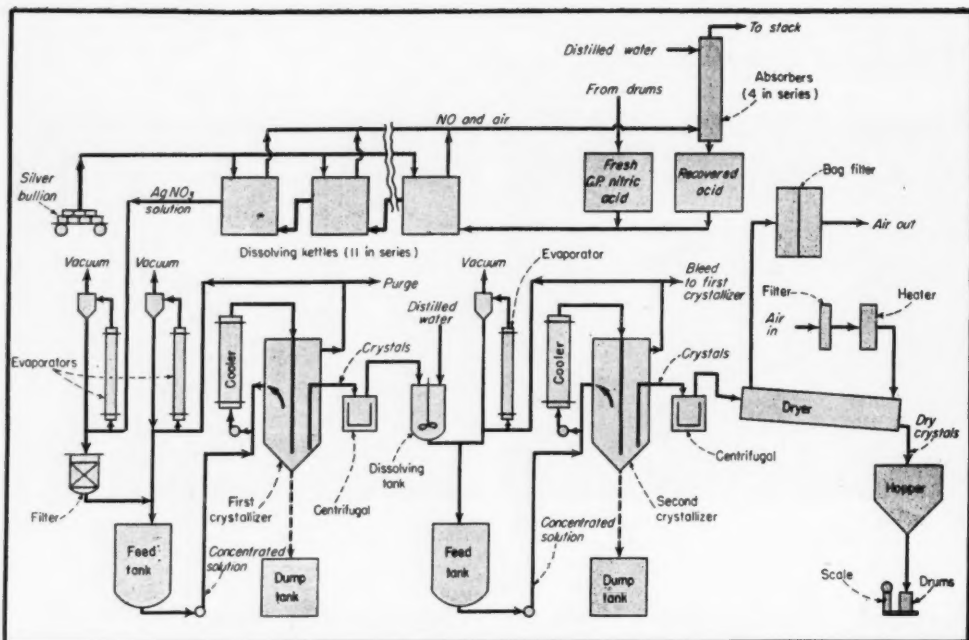
a battery of 11 3-ft. diameter jacketed tanks. C.P. nitric acid flows through the tanks in series in a cascade arrangement. Control is very simple; acid feed rate is set by a manual valve so that the AgNO_3 solution leaving the last dissolver in the series contains only a trace of free nitric acid. Flow from one tank to the next is by gravity overflow.

Operators keep the tanks full of silver bars, adding to No. 1 tank at frequent intervals and to the tanks near the end of the line much less often. (Each bar weighs 70 lb. and is worth more than \$800.) It may take weeks for a bar in the last tank to dissolve completely.

In the over-all dissolving reaction, one-quarter of the nitrogen in the acid is liberated as NO. The nitrous oxide is oxidized and absorbed in distilled water in a series of four 30-in. by 10-ft. packed towers. Recovered acid is reused.

Selection of tower packing is another of those critical details. The Raschig rings are made of Isolantite, a special porcelain which contains no nitric acid-soluble iron or aluminum.

The three Kodak-designed-and-built evaporators (see flow sheet) are all of the vertical long-tube, natural circulation type. Calandrias are 10 ft.



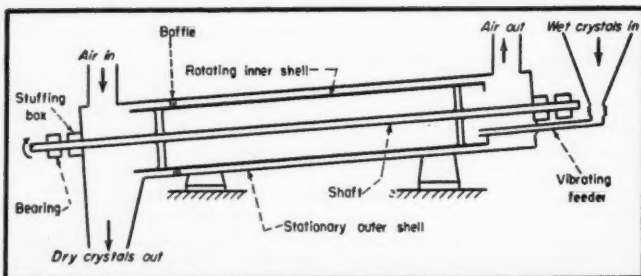
high, each with five 1-in. tubes. Single-stage steam jets pull about 10 in. Hg of vacuum, discharging to surface condensers. Evaporation temperature is about 200 deg. F.

► **Crystallization**—The Krystal crystallizers* are 4 ft. in diameter and 10 ft. high on the straight side. A circulating stream of 500 gpm. is withdrawn near the top, hot 85-percent solution from the evaporator enters at a rate of $\frac{1}{2}$ gpm. and the mixture is pumped through a tubular cooler. Chilled water, the cooling agent, maintains a temperature of about 70 deg. F. in this stream.

Each pound of 85-percent feed solution produces $\frac{1}{2}$ lb. of silver nitrate crystals. The excess mother liquor is reconcentrated and recycled.

Wet crystals are drawn off from a point near the bottom of the crystallizer. Here again is one of those interesting design tricks—crystals flow upward through an internal pipe, under the head of the slurry in the crystallizer, so that the draw-off point can be on the same floor as the crystallizer body.

* See "Chemical Engineers' Handbook," 3rd ed., pp. 1068-9, for a more detailed technical description of this type of crystallizer, licensed in U. S. by Struthers Wells Corp.



ROTARY DRYER is of special design to eliminate contamination and dust hazards. It has two shells, the outer one stationary and the inner rotating.

Each feeder for transferring crystals to the centrifugals is a vibrating tube with a longitudinal perforated plate, which permits mother liquor to drain from the crystals back into the crystallizer.

Centrifuging is the only batch step in the process. The centrifugals have 17-in. baskets rotating at 1,550 rpm. The baskets are perforated with $\frac{1}{8}$ -in. holes and covered with 80-mesh screen. Centrifuged crystals have a moisture content of only 0.3 percent.

► **Unusual Dryer Design**—The rotary dryer is another product of smart engineering design. The dryer had to be sealed, yet Kodak objected to

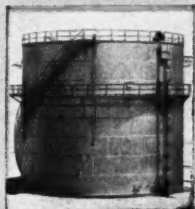
the usual peripheral seal as a potential source of contamination of the product as well as a dust hazard to the operators. The answer: Enclose the dryer with a stationary shell and support the inner rotating cylinder via spiders on a central shaft sealed through small-diameter stuffing boxes.

The inner cylinder is 18 in. in diameter and 10 ft. long, turning at 2 rpm. Steam-heated air is supplied at 220 deg. F. A vibrating tube conveyor sealed into the stationary part of the dryer feeds the wet crystals. Average travel time of crystals through the dryer is 4 min. and final moisture content is 0.05 percent (Continued)

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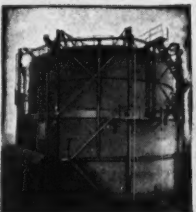
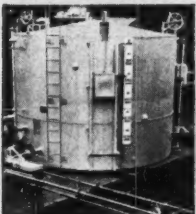
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Wiggins Gasholder

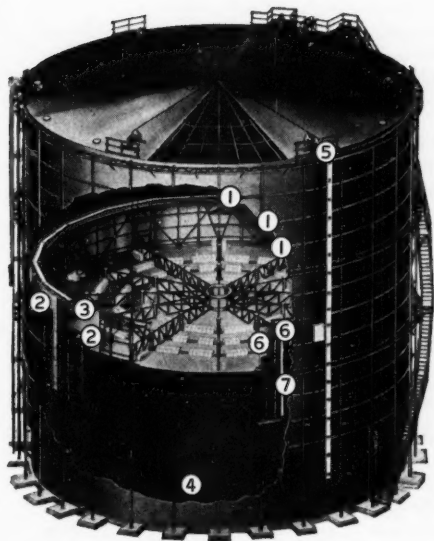
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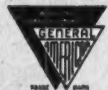
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► **Old Batch Process**—The new process represents a tremendous improvement over the old batch setup. Evaporation used to be done in large dishes on open steam tables. Then dishes were set aside on tables for crystallization. Production per dish was 20 lb. per day, requiring hundreds of them, each handled manually several times. Cabinet drying on glass trays took four days.

Operating crew under these conditions numbered about 25 men. The present crew consists of six men on the day shift and four men on each of the night shifts, turning out twice as much product as formerly. All operators, of course, are bonded.

Kodak considers the greatest benefit, however, to be the improved working conditions. The old setup required much heavy manual labor under extreme conditions of temperature and humidity.

Other advantages derived from the new process are a more uniform product and greatly increased output per unit of building space.

It's no wonder that Kodak is pleased with the achievements of its engineers in materials of construction, improvement in method and product, and reduction in hazard to personnel. Further expansion to meet the demands of the industry is a natural outgrowth.

Montana Refinery Getting Polymerization Reactor

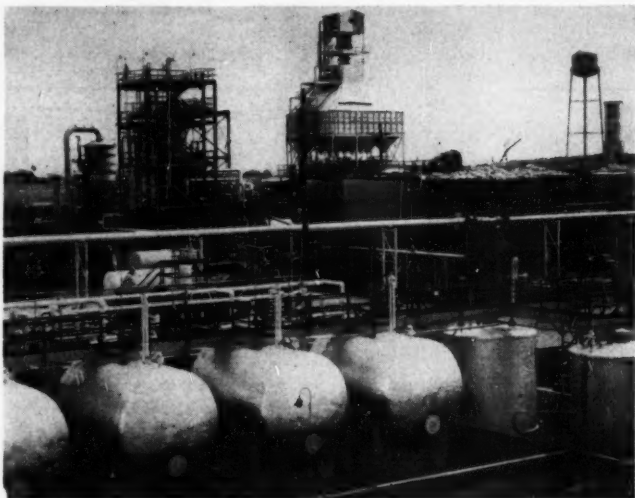
A catalytic polymerization unit and a waste heat boiler for the present catalytic cracking unit will be added at the Billings, Mont., refinery of Carter Oil Co. Design and construction will be done by the Chemical Plants Division of Blaw-Knox Co.

The polymerization unit will be a high-pressure shell and tube reactor employing solid phosphoric acid catalyst. Each day, 3.7 million standard cubic feet of cracking plant gas will be fed to the unit. When it goes on stream early next year the polymerization unit will produce 600 bbl. per day of 100-plus octane polymer

for use in blending premium-grade motor fuels.

The waste heat boiler will recover heat from flue gases coming from the catalytic cracking unit. It will increase

the plant's steam-generating capacity by 22,000 lb. per hr. Construction, now under way, is being handled by Blaw-Knox from its Tulsa, Okla., headquarters.



An Acrylic Plant Arises

A new acrylic fiber, Acrilan, will soon be coming in volume from the new Decatur, Ala., plant of Chemstrand Corp. The company is rapidly bringing the plant into production. It will turn out 30 million pounds a year of acrylic staple. Chemstrand is jointly owned by American Viscose Corp. and Monsanto Chemical Co.

Many steps are involved in the production of Acrilan. Basic chemicals are manufactured in Texas. Natural gas and air are combined to form ammonia, then natural gas and ammonia are combined to produce hydrocyanic acid. Natural gas itself is elevated in temperature and pressure to form acetylene. Finally, acetylene and hydrocyanic acid form acrylonitrile.

The liquid acrylonitrile is shipped to the Decatur plant, where it is polymerized and reduced to a white powder that looks like talc. This powder is dissolved to form the spinning solution. Extruded through spinnerettes, the fiber emerges as continuous filaments for further processing. The final steps involve cutting the

filaments into staple lengths, fluffing or opening, and baling for shipment to textile mills.

Chemstrand was organized in March 1949 by American Viscose and Monsanto to develop acrylic fibers. After laboratory research at Marcus Hook, Pa., Dayton, Ohio, and Springfield, Mass., a pilot plant, able to turn out 1 million pounds a year, began producing Acrilan staple in November 1950. Ground was broken at Decatur in February 1951.

Another significant event occurred in June 1951, broadening Chemstrand's position in synthetic fibers. Chemstrand became the first U. S. company to be licensed by Du Pont to produce nylon. In July 1951 work started on a plant at Pensacola, Fla., to make 50 million pounds per year of nylon filament yarn. Chemstrand expects it to come into full operation early in 1954.

When its current two-plant building program is completed, Chemstrand will have about 4,000 employees and assets exceeding \$150 million.



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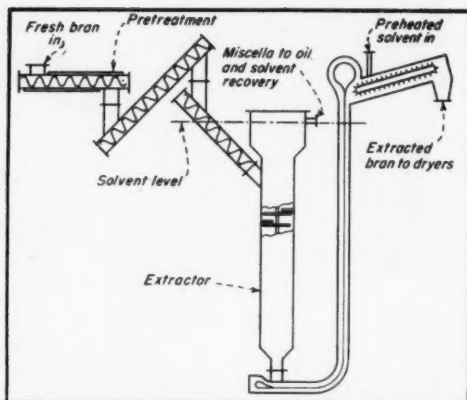
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COMPACTNESS of plant is evident here; building is 38 x 42 x 53 ft. high. Note 7-ft. overhanging eaves.



EXTRACTION UNIT uses novel feed and discharge arrangement to minimize solvent loss, get good final wash.

Rice Bran Yields Edible Oil

New plant extracts oil continuously with hexane in a countercurrent process. Flash vaporization and vacuum distillation recover solvent for reuse.

Rice-bran oil production commenced this June in the Houston plant of Wonder Rice Oil Co., subsidiary of Wonder Rice Mills.

This plant is one of two such units in the U. S. using a continuous solvent extraction process. It differs from the other plant* on two counts: It processes twice as much bran, produces semi-refined, rather than crude, oil.

Daily charge capacity is 100 tons of bran, yielding 30,000 lb. of oil. The extraction system was designed by Allis-Chalmers. The plant is under the direction of Millard Cassidy, who pioneered this process and was affiliated also with the earlier plant.

Bran is a by-product of the rice milling industry. Although its oil content varies with the source, it is generally about 15 percent.

► **How the Process Works**—The process is similar to other oil extraction processes but differs in equipment details.

Bran is brought from the parent company's adjacent rice mill, after removal from the rice grains, by an overhead enclosed screw conveyor. It is pretreated in a steam-jacketed screw conveyor to adjust moisture content and temperature.

Bran enters the extractor at a point somewhat below the solvent level, through two oppositely inclined screw conveyors (see cut). This bran feed arrangement is designed to provide a suitable seal for keeping solvent losses as low as possible.

Preheated commercial hexane, the solvent, is fed through the continuous-flow bran removal conveyor. It flows down the conveyor countercurrent to the ascending spent bran, giving the bran an extra lick of extraction.

The solvent floods both feed and discharge conveyors at the level of miscella overflow from the top of the extractor.

Extracted bran goes to a series of six vertically stacked dryers, each equipped with internal ribbon conveyors. Solvent vaporized in the dryers passes through a vapor scrubber tower where fines are knocked down, then into a condenser. Water is removed from condensed solvent by means of a decanter.

Free of solvent and odors, extracted bran leaves the bottom of the last dryer and is conveyed to the rice mill for bagging and shipping. It is sold as animal feed.

► **Solvent Recovery**—The hexane-oil mixture (miscella) is pumped from a receiving tank through pressure-leaf

filters to remove suspended bran particles. Clear filtrate passes to another surge tank, then to a steam-heated long-tube evaporator running at 225-230 deg. F., and from there to a flash chamber. Here 95 percent of the solvent flashes off, is condensed and returned to the solvent recycle tank.

Remaining solvent is separated from the oil in a bubble-cap vacuum tower. Stripped crude oil is pumped to storage in the tank farm. It is finally processed in a DeLaval two-stage centrifugal system. The first machine removes marketable waxes and gums and partially neutralizes the free fatty acids. Final polishing occurs in the second stage.

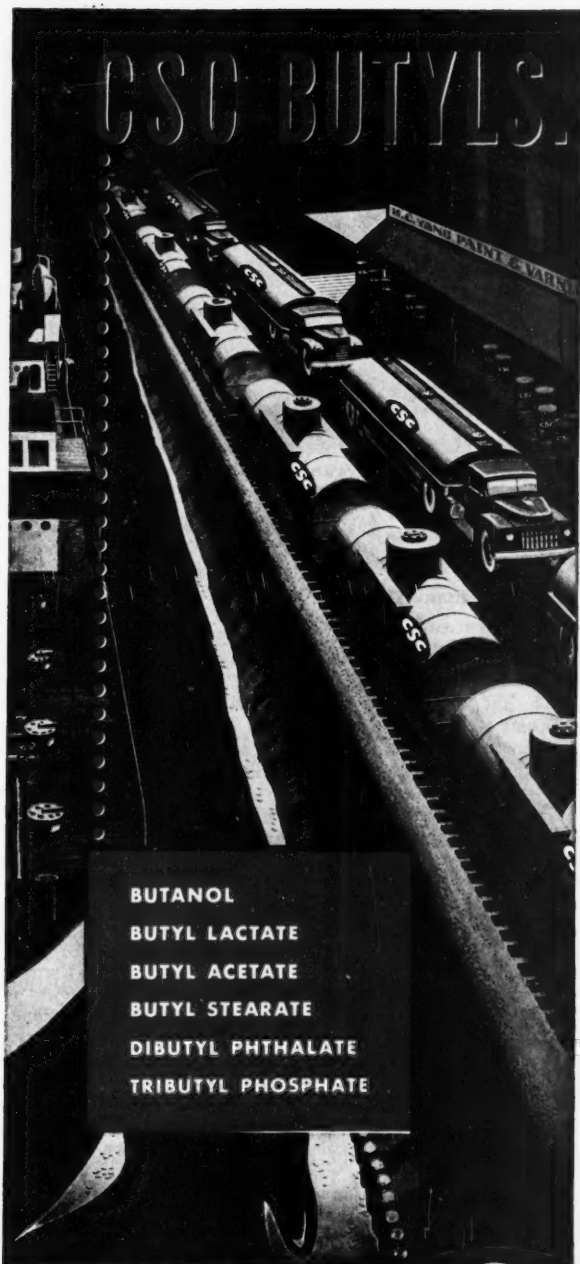
All electrical equipment is explosion-proof. All processing vessels and insulated pipelines are covered with sheet aluminum. Piping is color-coded for easy identification of lines.

► **Importance of Product**—Edible oil from rice bran has only recently become commercially important. It can be converted by conventional refining and bleaching procedures into a clear, light-colored oil having a good flavor. It is used primarily for salad and cooking oils.

The oil is stable, odorless, neutral, has an iodine value of 103 and is comparable to peanut oil. It is more resistant to oxidation or rancidity than the average cooking oil.

Recent experiments have developed several unique applications for rice-bran oil. Among these are rust inhibiting, production of sulphonated oils, and spraying of alfalfa for preserving valuable vitamins.

* See *Chem. Eng.*, Sept. 1950, p. 123.



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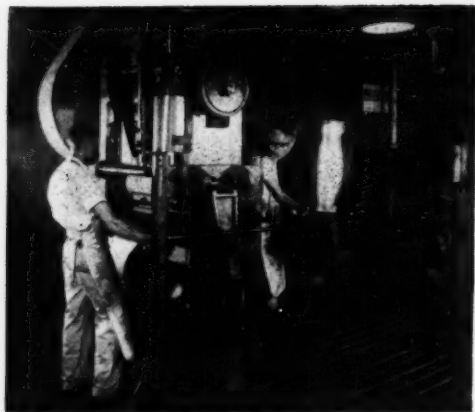
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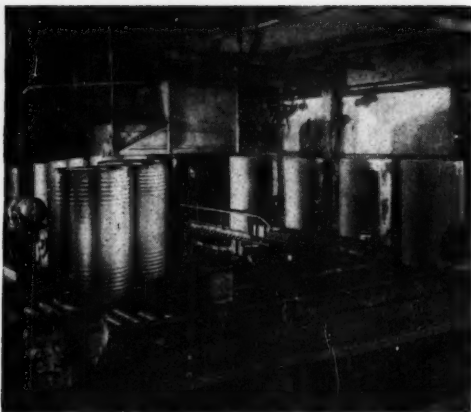
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CHEMICAL ENGINEERING—October 1952

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FORMING THE CYLINDER, a horn press operator is about to put a single-lock side seam on a bent shape.



READY FOR SPRAYING, drums of solid caustic (right) and flake caustic (left) meet point and pass on to a paint spray booth.

Diamond Rolls Its Own

Texas caustic producer finds it pays to make its own drums. The new drum shop cut inventories and storage expenses; lowered shipping and painting costs.

To ship an empty drum from a fabricator in Cleveland to a user in Houston costs \$1.08—about half the cost of making the drum. Not long ago, economy-minded officials of Diamond Alkali Co. figured it might pay them to make drums at the company's caustic soda-chlorine plant in Houston; they made up their minds soon after.

Today Diamond fabricates its own caustic drums. At the Houston plant it is now making large drums of 24-gage steel (to hold 700 lb. of solid or 400 lb. of flake) and smaller drums of 26-gage side thickness and 28-gage top and bottom (to hold 100 lb. of flake). Capacity output is 450 large or 750 small drums per 8-hr. day.

Right now Diamond is in the process of replacing the conventional single-lock, mechanical side seam with an all-welded seam. Anhydrous caustic has a high affinity for water; it will even hydrate from atmospheric moisture. With the new seam, Diamond expects to make a nearly air-tight package, minimizing damage to the caustic from water.

This improvement, plus a few additional container modifications now in the planning stage, will give as good a caustic container as it is possible to make, Diamond believes.

► **Integration**—The new drum shop gives Diamond a slick-running integrated operation. Caustic finishing, drum fabrication and filling take place on three parallel lines, all under one roof.

The drum shop is paying off in many ways:

- **Storage expenses** have been cut. Storage of drum inventory in the form of flat sheets is cheaper than storage of bulky finished containers.

- **Production schedules** are met more easily. Producers of solid caustic have to be ready to change quickly from one size and type of container to another. Previously, the company had to keep large inventories of various types and sizes of drums. Now the drum shop can shift its schedule to meet the demands of the chemical plant.

- **Indirect shipping costs** have been cut. A fabricator of drums can ship only 375-400 single-trip drums in a boxcar. A steel mill can ship in a single car enough sheet to make 3,200 drums.

- **Drum painting** has been halved. Formerly, drums had to be painted both before and after filling to protect them from atmospheric corrosion. In storage, sheet steel corrodes only on the edges. But the corroded parts are

trimmed off during the fabrication of the drums. Now the home-fabricated drums are painted only once—after they are filled.

To take care of ups-and-downs of drum demand, Diamond has worked out a flexible production schedule. The drum shop normally works only one shift; but when more drums are needed, the shop works a second shift, and could work a third if necessary. In addition, the drum shop absorbs surplus labor from elsewhere in the plant.

► **Making the Drums**—From storage, a fork-lift truck carries sheets of steel to a trimming machine. Although sheets arrive at the plant cut to approximate size, they must be further trimmed to exact size. At this time, the rusty edges are clipped.

A heavy machine picks up the trimmed sheets and rolls them into cylinders. A horn press then forms a single-lock side seam. A special compound in the seam resists attack by molten caustic.

A corrugating machine forms seven corrugations near each end of the drum. At the same time, the machine puts flanges on both ends. Next comes a semi-automatic head seamer, where both heads are put on, one at a time.

Heavy presses cut and form heads from different-size sheets. Heads for drums holding flake caustic are put into a smaller press; here a large filling hole is cut in the metal.

After the heads are put on, the completed drum passes to a mechanical lift that carries it to the mezzanine floor. An arm on the lift automatically pushes the drum onto a roller con-

veyor that takes the drum to storage or transfers it to another conveyor that takes the drum to the filling stations.

All machines have interchangeable parts so that they can fabricate either size drum. To change the parts requires 5 man-hr. and is generally done after hours by a maintenance crew.

► **Filling the Drums**—An operator, working a control panel in a glass-enclosed station, spots an empty drum on a platform scale beneath the manually controlled valve of a tank of molten caustic. After the drum is filled to a specified weight, he sends it through a 100-ft. long cooling tunnel. Temperature of the caustic falls from 600 to 200 deg. F.

Filling a drum with flake caustic, which takes place on a separate line, is simpler. An empty drum with the large opening in the head passes along a roller conveyor until it reaches a scale under the opening of a flake caustic hopper. A vibrator shakes down 400 lb. of flakes into the drum. An operator puts in a lithographed plug and expands it for a tight fit.

Because the drum is filled at low temperatures (160-200 deg. F.), it need not be cooled before painting.

At a point near the paint spray booth, the conveyors carrying drums of flake and solid converge. With temporary covers over the lithographed plugs, the drums pass through the booth and get a coat of asphalt-base paint. They next pass over a checking scale outside the booth.

When the drums reach the end of the conveyor, they are mechanically pushed onto a pallet. A fork-lift truck picks up the pallet, loaded with four drums, and carries it to a nearby boxcar or to storage. In storage, 400 or 700-lb. drums are stacked three high; 100-lb. drums are stacked four high.

Government Cutback Forces Shutdown of Alcohol Plant

Central States Corp., which has been operating the government-owned alcohol plant at Omaha, Neb., is ceasing alcohol production there.

When the government cut back its stockpiling program the plant had no place to sell its output. The Omaha plant has been a big supplier of alcohol to Rubber Reserve.

Central States is casting about for other production to keep the plant operating. Its 10-year lease still has eight years to run.

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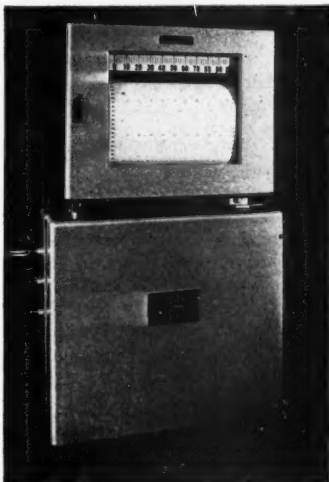
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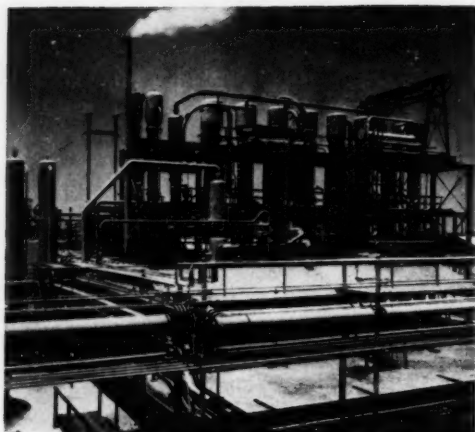
- For these reasons, end-point analysis and its control application have become of major significance to the process engineer.
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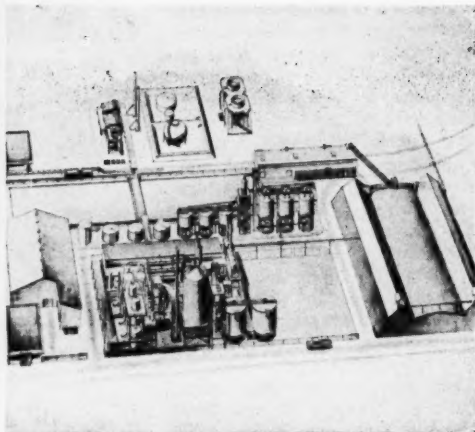
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33 UNIVERSITY ROAD

CAMBRIDGE 38, MASSACHUSETTS



WASTE ACID from Shell's alcohol plant helps make . . .



ALUMINA and ammonium sulphate in Filtrol's new plant.

Sulphuric Triple Play

Shell Chemical and Filtrol make putouts by combining outputs, get the ultimate value out of otherwise useless waste products.

A unique agreement, just concluded between Filtrol Corp. and Shell Chemical Corp., goes the limit in stretching supplies of critically short sulphuric acid.

Filtrol will build a plant in Vernon, Calif., to recover high-purity alumina and magnesia from the effluent of its present Vernon operations. Spent sulphuric acid from Shell's organic chemicals plant in nearby Dominguez will be used in the recovery process, after which Filtrol will combine the acid with ammonia to produce substantial amounts of much needed ammonium sulphate.

Additional amounts of waste acid from Shell's plant, used in Filtrol's present operations and subsequently lost in the effluent, will also be recovered and made into sulphate. Filtrol will take spent acid and fresh ammonia from Shell; Shell will get sulphate from Filtrol, at Vernon, for shipment to its regular customers.

► **Disposal Problem**—When Filtrol expanded its natural catalyst plant at Vernon in 1948 it found that the municipal sewage system could not handle the increased amount of effluent. So Filtrol has had to neutralize about 3½ million gal. of highly acid effluent per week, remove most of its

sulphate content and truck the liquid residue three miles to the main sewer. These operations have cost the company about \$500,000 per year, all down the drain.

Preliminary research on the problem indicated that it might be possible to produce synthetic alumina and magnesia catalysts from the effluent. Filtrol's president, Wright W. Gary, felt that if the catalysts developed as expected the market for alumina and magnesia would be strong enough to support the project.

So Filtrol stepped up its research and development program to the point that it now has a semi-works plant in operation and design of a new plant under way. Cost of the semi-works was \$250,000; its operation leading to the present design cost another \$250,000.

Basically, the process involves concentration of effluent to strong mother liquor, followed by treatment with sulphuric acid in special equipment. Process changes in the production of Filtrol's natural catalysts were made in order to produce a stronger effluent, which is then concentrated further. Originally, virgin acid was used to treat the resulting slurry, but about two years ago changes in the pilot operation (which has been supplying

two hydroformers' needs for hard but porous alumina) permitted use of waste acid. This led to the present agreement with Shell.

► **Everybody Benefits**—Advantages to Shell: For all practical purposes, Shell increases its ammonium sulphate capacity without increasing its capital investment.

Advantages to Filtrol: It eliminates a costly waste problem, recovers valuable by-products and, through sale of ammonium sulphate to Shell, receives help in amortizing the capital investment of its by-products plant.

According to Gary, of the 250-odd uses for alumina the most promising is in hydroforming. As was the case in earlier refining methods, hydroformers are slowly shifting from fixed to moving bed and fluid techniques. Lack of a low-cost catalyst of sufficient purity has retarded the shift to some extent, but if Filtrol's new alumina catalyst meets expectations the industry may have its catalyst. The new catalyst, coming as it does from waste materials, should cost less than comparable products, and at no time during processing does it come near soda, the major source of catalyst impurities.

Filtrol is also working on its effluent to develop a lightweight iron catalyst for gas conversion. Industrial acceptance of these catalysts will mark Filtrol's entrance into the synthetic catalyst field—in the past all of its products were obtained directly from clays.

Final engineering on the new plant will be done by J. H. Pomeroy Co.

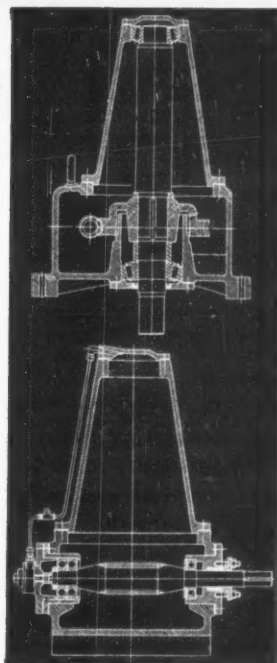


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The views above illustrate cross sections through the worm and worm gear shafts. Note absence of stuffing box on vertical shaft (at top).

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TECHNICAL TOPICS

FACTORS AFFECTING THE CORROSION RESISTANCE OF STAINLESS STEELS

NORMAN S. MOTT

Chief Chemist and Metallurgist

Much doubt exists today as to the influence on the corrosion resistance of stainless alloys of such factors as metal surface condition, grain size, cold working, chemical composition, magnetism and passivity. This discussion will attempt to explain these factors and their influence.

1. The smoother the surface of the metal, the better the corrosion resistance; thus ground or machined surfaces are better than those which are sand blasted, and a polished surface is the best.

2. Small grain size in austenitic stainless steels decreases the tendency to intergranular attack, but the general overall corrosion rate is not affected to any great extent by grain size.

3. Cold working austenitic stainless steels decreases the tendency to intergranular attack through the production of a small grain size and precipitation of carbides along strain lines rather than at the grain boundaries. Its effect on the overall corrosion rate however is to increase it.

4. Chemical elements such as chromium and aluminum are corrosion resistant in oxidizing acids and others such as nickel, copper and tungsten are corrosion resistant in reducing baths. Some, such as molybdenum and silicon, are resistant to both. Alloyed, these properties may reverse to a certain extent; however, in general, their corrosion tendencies hold true for the more gross additions.

5. Magnetism in stainless steel is produced by the chemical composition balance and/or cold work. Its effect on the corrosion resistance is related

only to that effect produced by these sources directly, and not to the magnetism as such. Chromium, silicon, molybdenum, columbium and titanium form a magnetic phase known as ferrite; and nickel, carbon and manganese form the non-magnetic phase austenite. The balance of these elements considering their relative degrees of potency, determines whether or not the stainless steel is magnetic. The presence of ferrite in moderate amounts (5-10%) in the austenitic stainless alloys greatly decreases the tendency to intergranular corrosion but has little effect on the overall corrosion rate. Ferritic type alloys do not corrode intergranularly.

6. Passivity, a condition of nobility on low corrosion rate, is mainly a physico-chemical surface characteristic of stainless steel, and is produced mainly by its chromium content. Passivity is first apparent around 12 percent and is not really effective until about 18 percent is reached. Additions of nickel increase the passive effect, and thus an 18 chrome 8 nickel alloy is more corrosion resistant than the 18 percent chrome type. Passivity is further promoted by additions of certain other elements, mainly molybdenum. The exact nature of passivity is still in dispute; however, it is known that while some media promote passivity; others break it down. Air, oxygen, adsorbed gases, nitric or chrome acids, and a high polish promote passivity and chlorides, hydrochloric or sulfuric acids break it down. In dilute hydrochloric and sulfuric acids, 18-8S and 18-5Mo remain passive until a critical percentage or temperature is reached then passivity breaks down and active violent corrosion proceeds.

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(Advertisement)

News, cont. . .

The plant, to be built by Filtrol, will cost slightly over \$5 million. It is scheduled to go on stream in the fall of 1953, shortly after Shell's Ventura ammonia plant is scheduled for completion.

Glidden Makes Chlorophyll By Process Julian Developed

Crude chlorophyll is now being produced by Glidden Co. at its flaxseed extraction plant in Buena Park, Calif., by a process developed by Dr. Percy L. Julian, research director for Glidden's soya products division in Chicago. The chlorophyll is made from alfalfa.

Pilot quantities of chlorophyll have already been turned out successfully. Glidden's Buena Park plant is located in the center of the southern California alfalfa belt.

Glidden is producing only the basic chlorophyll. It will be marketed to other processors for refining and compounding.

The process developed by Julian does not require extensive modification of the Buena Park facilities, and the same process can be used in two other Glidden oil extraction plants in Chicago and Indianapolis.

Glidden does not expect large revenues from the new chlorophyll process, but looks on it as a means to make fuller use of existing equipment.

Monsanto to Let Formulators Use Its Soil Conditioners

Monsanto Chemical Co. will license formulators to use its patented soil conditioners. "A separate program for the sale of Monsanto soil conditioners to formulators is also being initiated," according to John L. Gillis, vice president of the company and general manager of organic chemicals.

"As part of this program," Gillis explains, "Monsanto will provide formulators with technical assistance, including application information, concerning the Monsanto soil conditioner sold in each instance."

A modified vinyl acetate-maleic acid compound will be the first product offered. Tests by Monsanto and others have proved it to be an effective soil conditioner.

Formulators will use their own brand names and will be free to list the

chemical composition of the product on container labels. The fact that the formulators are licensed under soil conditioner patents issued to Monsanto will also be stated on the labels.

Gillis emphasizes that up to now Monsanto has sold no soil conditioners to formulators. Monsanto will continue to expand its sales of Krilium soil conditioner through distributors and dealers throughout the nation.

"It is Monsanto's conviction that the public will best be served by our licensing of responsible formulators," Gillis says. "This action by increasing the available supply of effective material will help to clarify some of the confusion caused in the soil conditioner market by exaggerated claims for untested materials."

CONVENTION CALENDAR

Association of Consulting Chemists & Chemical Engineers, annual symposium, Belmont Plaza Hotel, New York, October 28.

Salesmen's Association of the American Chemical Industry, chemical sales clinic, Commodore Hotel, October 28.

American Association of Textile Chemists & Colorists, annual meeting, Statler Hotel, Boston, November 6-8.

American Council of Commercial Laboratories, annual meeting, Schenley Hotel, Pittsburgh, Pa., November 12-14.

National Paint, Varnish & Lacquer Association, annual convention, Palmer House, Chicago, November 17-19.

National Fertilizer Association, annual meeting, Roney Plaza Hotel, Miami Beach, November 19-21.

American Society for Quality Control, 7th Midwest conference, Claypool Hotel, Indianapolis, November 20-21.

Federation of Paint & Varnish Production Clubs, annual meeting, Palmer House, Chicago, November 20-22.

Manufacturing Chemists' Association, semi-annual meeting and winter conference, Statler Hotel, New York, November 25.

20th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, December 1-6.

Chemical Specialties Manufacturers Association, annual meeting, New Yorker Hotel, New York, December 7-9.

American Institute of Chemical Engineers, annual meeting, Cleveland and Carter Hotels, Cleveland, December 7-10.

American Pharmaceutical Manufacturers Association, midyear meeting, Waldorf-Astoria Hotel, New York, December 8-10.

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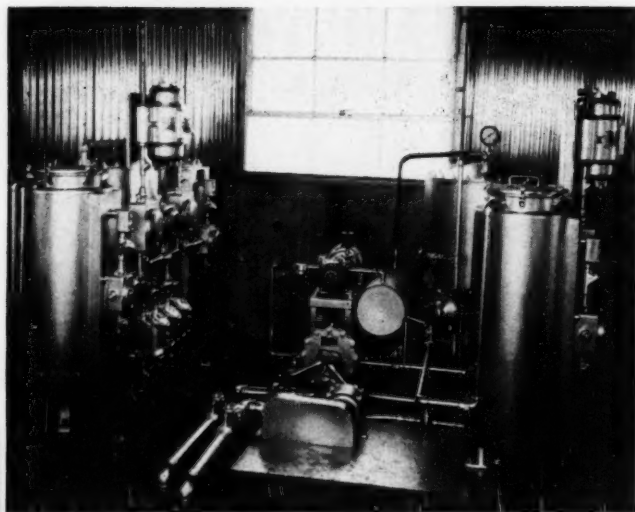
DAY Gearless Type Pony Mixers are known throughout the industrial world for efficient, dependable operation. Here are the reasons: The one-piece cast head is perfectly counter-balanced for effortless tilting. Planetary mixing action with anti-thrust agitator blades effects a rapid, thorough mix. Absolute rigidity is assured by a one-piece casting for the main frame. A single geared head motor drives both agitator and can gear; single or two-speed motor optional. Stainless steel agitator blades, scrapers and cans available at extra cost. Working capacities from 40 to 125 gallons.

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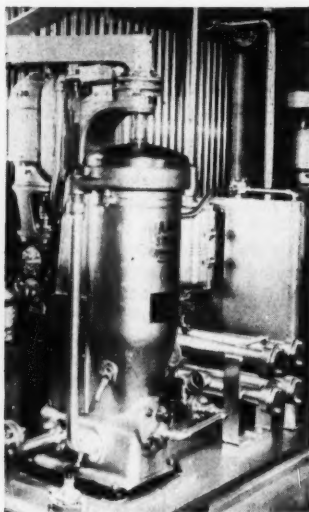


THE J. H. DAY COMPANY, CINCINNATI 22, OHIO

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VAPORIZERS remove water and other volatiles from engine lube oil.



CENTRIFUGES purify air-filter oil.

Reclaiming System Saves Oil

Reynolds' new aluminum plant runs on engine-generated power. Reconditioning of engine lube oil and air filter oil plays an important role.

Generating 175,000 kw. of electric power with gas engines takes a lot of lube oil and air filter oil.

So engineers designing the new Reynolds aluminum reduction plant down at Corpus Christi decided that a setup of this size needed a first-class system to handle and recondition the oil.

Although the plant isn't yet completed, one of the two separate oil treating systems is already operating.

And Reynolds' plant people are pleased with it, too—periodic determinations of Nute number (cleanliness) and viscosity show that the reclaimed oils are virtually as good as fresh oils.

The reduction plant is designed to turn out 160 million lb. of aluminum pig per yr. at full capacity. Limited production started on April 24.

► **Diesel-Run Generators**—Power for the plant will be supplied by 83 diesel engines running on 50 million cu. ft. per day of natural gas. There are 42 3,700-hp. Cooper-Bessemer engines and 41 3,000-hp. General Motors engines. Reynolds ordered engines from

two manufacturers in order to get the plant finished sooner. At present only the C-B engines are operating.

The treating system can handle three oils; one cut-back oil for the air filters and two engine lube oils. Separate facilities have been provided for oils for the C-B engines and the GM engines so that different types of oils could—if desirable—be used.

The reclaim building houses the reconditioning equipment and pumps for handling all new, dirty and reclaimed oils. It is conveniently located with respect to the three power buildings, oil tank farm, railroad spur and truck roadway.

New oil, as unloaded from railroad tank car or tank truck, goes through a meter, strainer and filter on its way to storage. There is one 15,000-gal. tank for each type of oil.

New oil is used for make-up. At present about 400 gal. per day is required to make up losses from the C-B engines; losses come mostly from leaks and drainage.

There is one 15,000-gal. storage tank for each of the two types of re-

claimed lube oil. Positive-displacement pumps withdraw reconditioned oil from storage and deliver it through strainers and meters in each of the three power houses to the individual gas engines.

Two pumps at each of the three power houses periodically transfer used oil from the engines to the 2,000-gal. used oil tanks in the reclaim area. Meters determine the volume of lube oil used by any power house or by any individual engine.

► **Vacuum Flashing**—This used oil is pumped through meters to one of the three Hoffman vaporizers in the reclaim building. Here it is electrically heated so that water and other volatiles are vaporized and removed by a vacuum pump. The reconditioned oil is pumped to the clean oil storage tanks.

Cut-back oil used in the air filters is handled somewhat differently, although in the same area as the lube oil. Tank truck or tank car unloading equipment in the reclaim building pumps and meters new oil to an 8,000-gal. storage tank. Another 8,000-gal. tank holds the reconditioned cut-back oil.

The clean reconditioned oil is pumped through meters to the individual air filters at the power houses. Losses of air-filter oil are much higher than lube oil, principally because of rain water.

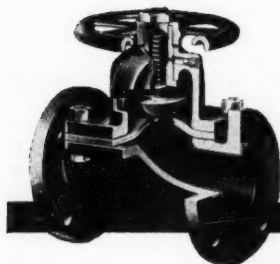
(Continued)

An announcement
to the processing industries

You can now have
TRANSFER MOLDED
SARAN LINED
BODIES
for **HILLS-McCANNA** *saunders patent*
Diaphragm Valves

To meet the processing industry's need for a corrosion resistant valve that makes effective and satisfactory use of the characteristics of Saran, Hills-McCanna now offers Saunders Patent valves with transfer molded Saran lined bodies. Saran linings applied in this manner provide new high standards of serviceability and life that were previously unavailable.

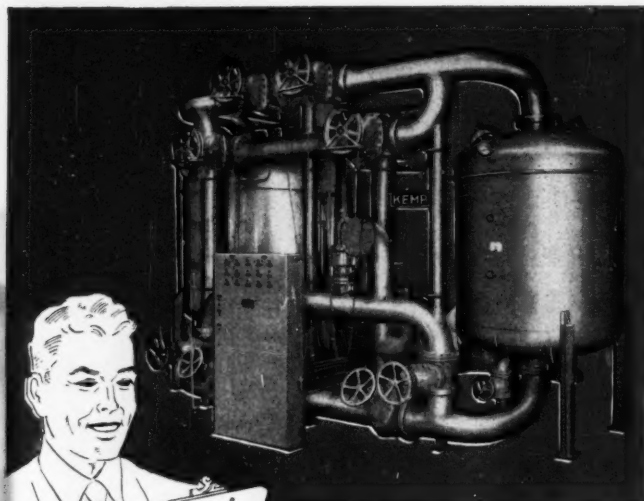
Hills-McCanna Saran lined valves of this type are available in sizes from 1 inch through 6 inches with flanged bodies only. Screwed end solid Saran bodies are available in sizes from 1/2 inch through 2 inches. All sizes, screwed end or flanged may be equipped with Saran Rubber diaphragms or diaphragms of any of 15 other materials. We will be pleased to send further information on request. HILLS-McCANNA CO., 2341 W. Nelson Ave., Chicago 18, Illinois.



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News, cont. . .

► **Settling and Centrifuging**—Oil from the air filters picks up a huge volume of impurities. Used oil is periodically removed from the air filter sumps and pumped to three 1,200-gal. cone bottom settling tanks.

Dirt and water are drained off into a pit. Getting rid of these impurities cuts down maintenance on the reconditioning equipment. The small amount of oil that goes off with the dirt and water is burned in the pit.

Oil from these tanks is pumped through a strainer to one of three Sharples centrifuges. Here the remaining water, dirt, sludge and other impurities are removed. From the centrifuges the clean oil is pumped to storage.

Improved Process Makes Magnesium Trisilicate

Magnesium trisilicate is now being manufactured by a new process at the Phillipsburg, N. J., plant of J. T. Baker Chemical Co. The product is a free-flowing, fine, white powder used in antacid preparation. The new process reduces the user's cost of end-product output.

Baker claims the new form of magnesium trisilicate mixes readily with other ingredients and granulates easily. In addition, it's claimed that it pours freely from drums and bottles, and reduces the dust problem.

More even coating with powdered solid lubricants and maintenance of uniform color in a finished product are other advantages, according to Baker.

Carborundum to Produce Zirconium and Hafnium

A new plant for production of zirconium and hafnium sponge metals will be built by the Carborundum Metals Co., Inc., recently formed subsidiary of the Carborundum Co.

The new subsidiary was organized to supply zirconium and hafnium to the Atomic Energy Commission. Carborundum Metals will sell about 150,000 lb. of zirconium and hafnium sponge metal per year to AEC for five years.

The plant will be located about 30 mi. southeast of Niagara Falls, N. Y., on an 18½-acre site just outside the village line of Akron, N. Y., in the town of Newstead.

Construction is just getting under way. Manufacturing facilities will consist, initially, of three buildings, according to Niles C. Bartholomew, vice president of Carborundum Metals. The entire plant will be designed, built and operated by Carborundum Metals. Equipment of the latest design will be installed, including the most modern equipment for dust and fume control.

Both zirconium and hafnium are produced from zircon sand presently obtained from Florida. The AEC's present requirements for these metals are being met by production at government-owned facilities. They are used in construction of nuclear reactors.

New Mixed Bed Deionizer Treats Boiler Feedwater

A new ion exchange process for demineralizing feedwater for high-pressure boilers was disclosed for the first time by Martin E. Gilwood, research director of the Permutit Co., at the recent Chicago meeting of the American Institute of Chemical Engineers. Simultaneously, Gilwood took the wraps off Permutit's newest development, an automatically regenerated mixed bed demineralizer specially designed for treating boiler feedwater.

"There has been a continuing trend for many years," Gilwood stated, "to design steam power plants for operation at higher and higher pressures and temperatures in order to attain better thermal efficiencies. Boilers and turbines operating at 1,000 to 2,400 psi. and at temperatures up to 1,000 deg. F. have become more and more common. At these high operating pressures, difficulties with scale, deposits and carryover in the steam are multiplied. It is, therefore, essential to provide boiler make-up water containing a minimum of impurities for this purpose.

"Mixed bed demineralizing will minimize these operational problems," according to Gilwood. "With the introduction of this system, it is now possible to produce water which is low in electrolyte and low in dissolved silica through the medium of ion exchange."

Demineralization of high-pressure boiler feedwater makes possible trouble-free steam power plant operation. It is being watched with keen interest by all engineers.



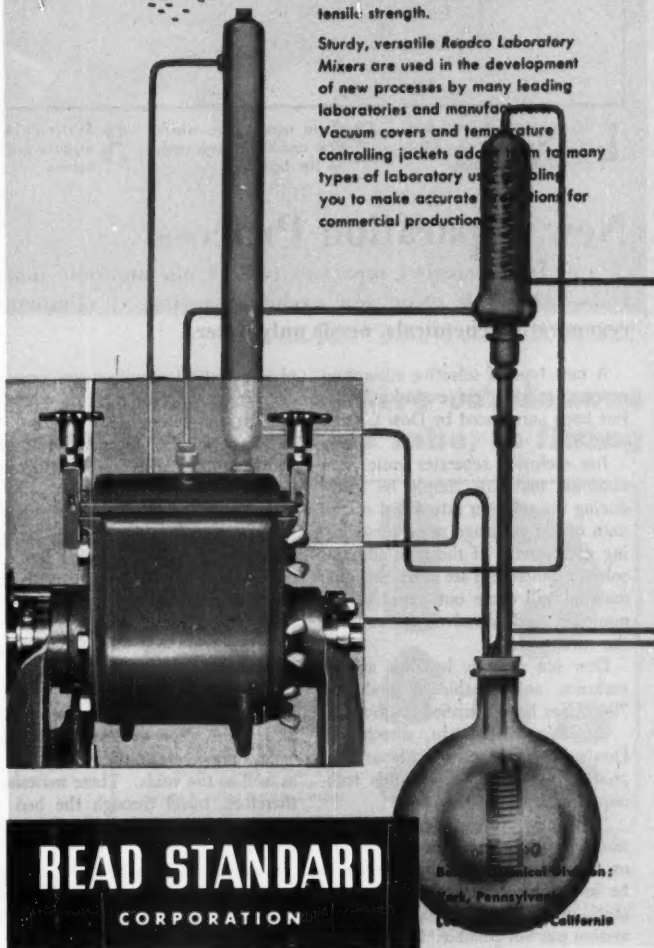
Readco Laboratory Mixer

speeds resin extraction from uncultivated rubbers

A rapid, efficient means of extracting resins from uncultivated rubbers has been developed by the National Bureau of Standards utilizing a Readco Laboratory Mixer.

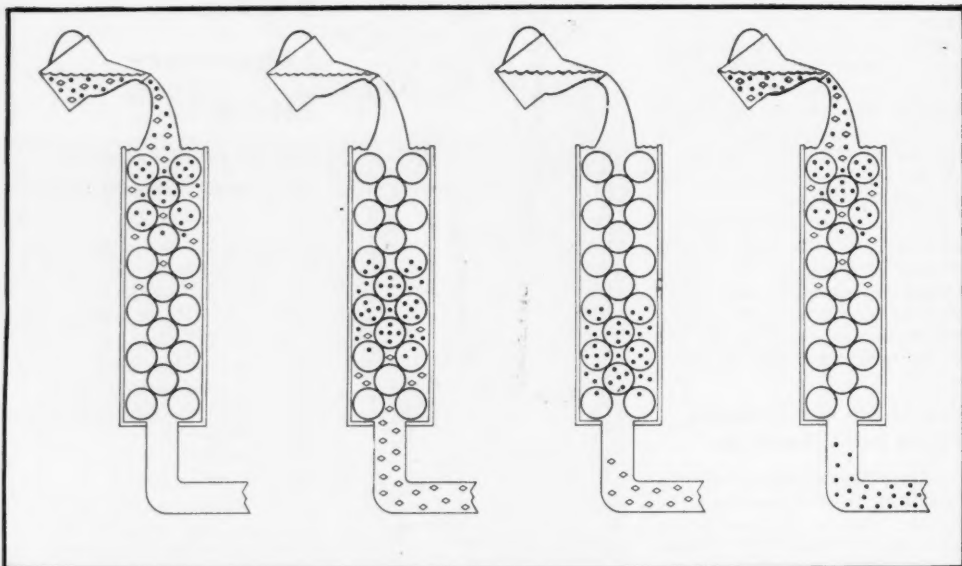
National Bureau of Standards tests prove that mastication of rubber samples in the mixer during extraction greatly speeds production of vulcanizates having superior tensile strength.

Sturdy, versatile Readco Laboratory Mixers are used in the development of new processes by many leading laboratories and manufacturers. Vacuum covers and temperature controlling jackets add them to many types of laboratory use, enabling you to make accurate predictions for commercial production.



READ STANDARD
CORPORATION

Readco Chemical Division
Pittsburgh, Pennsylvania
Los Angeles, California



- 1** Mixture of ionic and non-ionic materials is introduced into column.
- 2** Resin rejects ions, which flow rapidly through voids in the bed.
- 3** Water picks up the ionic material first, nonionic lags behind.
- 4** Nonionic material emerges at bottom, cycle can be started all over again.

New Separation Process

Ion exclusion separates ionic from nonionic materials. Although using ion exchange resins, it eliminates regenerating chemicals, needs only water.

A new type of selective adsorption process, called "ion exclusion," has just been announced by Dow Chemical Co.

Ion exclusion separates ionic from nonionic materials simply by introducing the solution into a bed or column of ion exchange resin, then rinsing with water. If the flow rate and column dimensions are right, the ionic material will come out ahead of the nonionic, each dissolved in some of the rinse water.

Dow has recently installed an ion exclusion unit capable of producing 70 gal. per hr. of purified solutions.

Dr. W. C. Bauman, director of Dow's physical research laboratory, predicts a rosy future for this technique. He states:

"This new process offers many possibilities for bringing new chemicals on the market which otherwise would be impossible because of production costs, or because chemically the separation was not possible. For example,

pharmaceutical manufacturers, organic chemical manufacturers and manufacturers of detergents and soaps, as well as petroleum processors and other manufacturers, will find use for ion exclusion."

► **Exclusion vs. Exchange**—Although the process uses ion exchange resins, it differs from conventional ion exchange in that the ionic materials are rejected, rather than retained, by the resin. As a result, the ions quickly pass through the voids in the bed of resin particles.

Nonionic materials, on the other hand, show no great tendency towards either adsorption or rejection by the resin; they permeate the resin particles as well as the voids. These materials, therefore, travel through the bed at an appreciably slower rate than the ionic.

Almost any type of ion exchange resin may be used, according to Dow. However, the more strongly ionized resins are preferred.

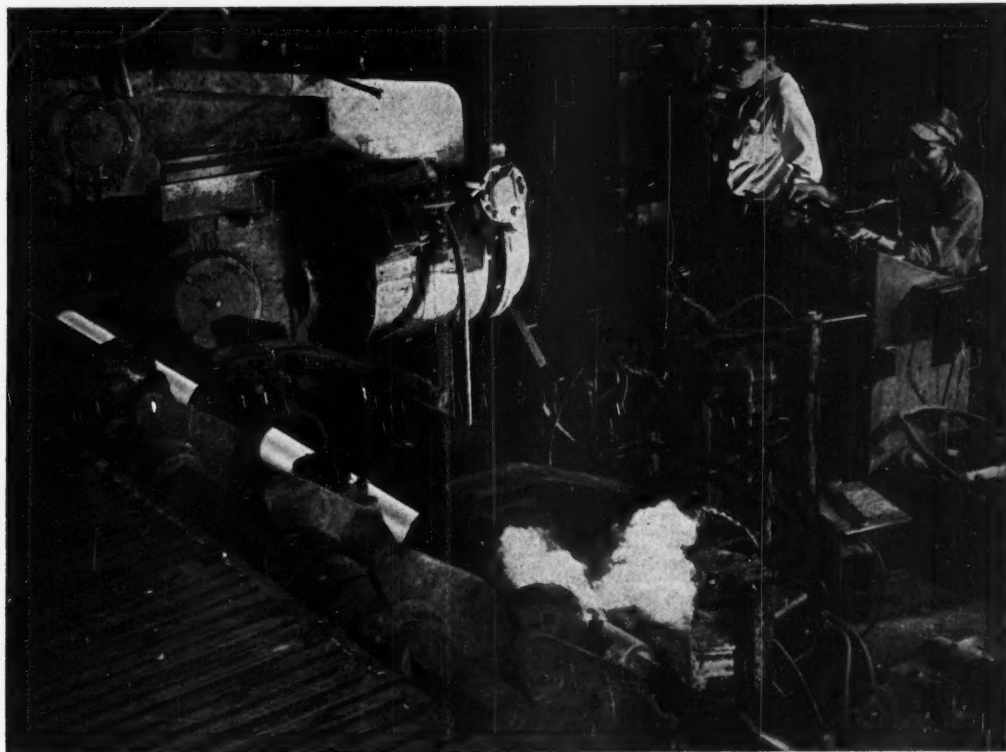
It is essential that the resin be in the same ionic form as the ionic material which is being separated. For example, the sodium form of a cation exchanger or the chloride form of an anion exchanger would be used when sodium chloride is to be separated from some nonionic material, such as methanol.

The strongly acidic cation exchange resin, Dowex 50 (sulphonated polystyrene type) has been used for the majority of the ion exclusion experiments by Dow researchers. Generally, ion exclusion will use a resin of smaller particle size than is commonly used in ion exchange. The resins that have shown most promise to date are of 50 to 100 mesh size.

► **Additional Tool**—Ion exclusion will add one more technique to the chemical engineer's kit of unit operations. It may make possible many separations which were not economically feasible before, by either ion exchange or physical methods of separation, such as distillation or evaporation.

Its advantages over ion exchange is that it can economically handle high concentrations, requires no regenerating chemicals (water is the regenerating agent), and needs no equipment for handling corrosive materials. Chief draw-

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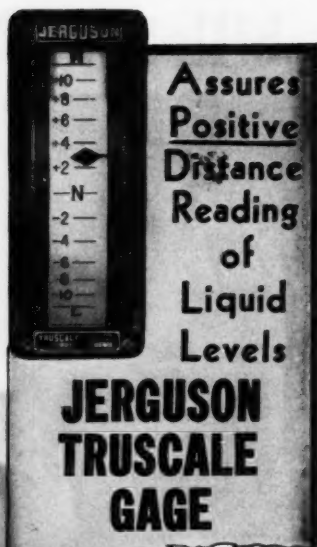
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News, cont. . .

back seems to be the fact that the separated solutions are more dilute than the original solution.

Dr. Bauman sums up the outlook as follows: "Ion exchange will still be the more economical operation where salt content is relatively low and ion exclusion where salt content is relatively high."

Dow has applied for patents, plans to license users of the process.

New Process Offers Boon To Small Oilseed Crushers

Packaged plants for direct extraction of oil from cottonseed and other seeds of high oil content by the filtration-extraction process are being offered to mills of 75 tons and up by the Lukenweld Division of Lukens Steel Co.

Designed so the smaller cottonseed crusher can economically convert to solvent extraction without pre-pressing, the Lukenweld process was developed after 18 months of research. It is based on the successful experiments of the Southern Regional Research Laboratory, U.S. Department of Agriculture. Standard plant capacities of 75, 100, 125 and 150 tons will be offered, with special systems available to meet individual requirements.

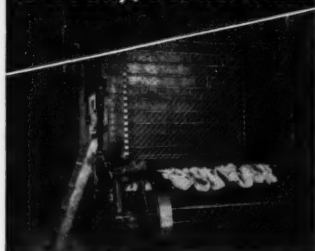
The Lukenweld filtration-extraction process is expected to achieve this performance in commercial operation: (1) an oil yield of better than 98 percent with residual oil in meal of less than 1 percent; (2) high meal purity with gossypol content of 0.03 percent maximum and thorough solvent removal; (3) top-grade oil quality for type and condition of seed processed; and (4) solvent recovery of more than 99 percent.

Besides eliminating the pre-pressing operation, the Lukenweld process can be used with presently installed delinting, de-hulling, cleaning, storage, crushing roll, and cooking equipment. Operation of the packaged plant is continuous and automatic, requiring a minimum of labor and technical supervision.

Development of this type of processing plant marks Lukenweld's entry into the cottonseed oil industry after many years as a designer and builder of process equipment for chemical plants.



**this conveyor belt
is woolly, but not wild!**



That's a true turnabout for this example of a specially designed Cambridge woven wire conveyor belt. This one carries wet, washed wool through a drying oven to remove moisture and washing chemicals from the fibre. There's no wild belt travel because the Cambridge Chain Drive design used here prevents the belt from riding from side to side across the pulleys... maintains straight belt movement.

Open mesh of the wire belt permits free, even heat circulation. All-metal construction gives longer belt life and lower maintenance costs.

Whether you're processing textile fibres, foods, chemicals, metal or ceramic products, a Cambridge woven wire conveyor belt can help you cut production costs and maintain product uniformity by combining movement with processing. But don't have the wool pulled over your eyes on conveyor belt design... be sure to call in your Cambridge field engineer for his recommendation on the proper—

CAMBRIDGE WOVEN WIRE CONVEYOR BELT—any metal or alloy, mesh or weave.

Write direct or look under "Beltting-Mechanical" in your classified telephone directory.

FREE BELT MANUAL contains information on conveyor and belt design and specifications, metallurgical data and belt maintenance. Write for your copy today.



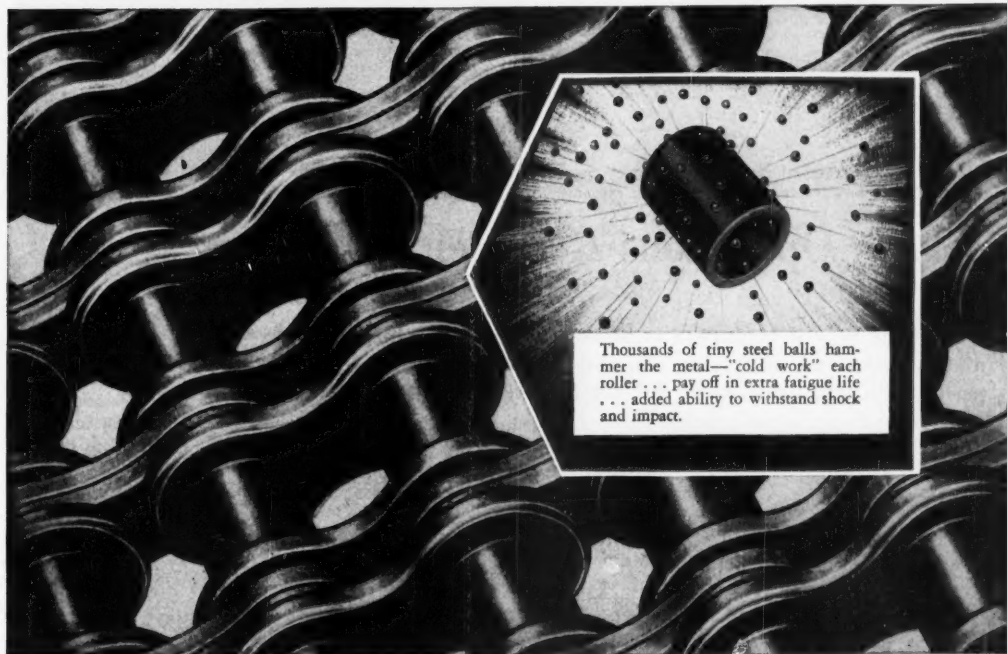
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look for the darkened rollers!

THERE are sound reasons for the universal acceptance of Link-Belt Precision Steel Roller Chain. Two of them—shot-peened rollers and Lock-type Bushings—are shown here.

Others include Link-Belt's rigid material selection and controlled heat treating—your assurance of absolute uniformity with no weak members.

Whether it's for drive or conveyor service, you can get the best in roller chain from the complete Link-Belt line—single and multiple widths, in $\frac{3}{8}$ " through 3", and double pitch, 1" through 3". Next time you need roller chain, call the Link-Belt office near you.



PRECISION STEEL ROLLER CHAIN

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in Principal Cities. 12,847



Lock-type Bushings increase ability to withstand shock loads

A special manufacturing process securely locks the inside sidebars on the bushing, preventing lateral movement of the sidebars and eliminating a common cause of stiff chains. This Link-Belt development is applied on roller chains through 1" pitch and double pitch roller chains through 2" pitch.

PROBLEM:

Total cost Production costs Inventory costs

$$C = \sum C_p (P_m) + \sum C_I (I_m)$$

SOLUTION:

Lowest cost schedule

$$\frac{d C_p (P_m)}{d P_m} + \sum_m \frac{d C_I (I_m)}{d I_m} = \text{Constant}$$

These equations, formulated by an OR team, explained . . .



. . . a complex inventory problem, saved \$225,000.

What's Operations Research All About?

Industry is beginning to awaken to the possibilities of this technique of solving complex problems. It's been used with marked success by the military for a decade.

Seventy-five scientists from university, industrial and military establishments in the U. S. got together a few months ago to organize the Operations Research Society of America. It's the first professional group of its kind on this side of the Atlantic.

Meeting at Columbia University's Arden House in Harriman, N. Y., they chose for their president Philip M. Morse, professor of physics at M.I.T. and wartime head of the Navy's operations research group. Plans were made to publish a society journal; the first issue will be out this month. National meetings have been scheduled for Washington next month and Cleveland in the spring.

► **Going Into Industry**—Many companies, including chemical companies, have shown an interest in operations research; a few progressive organizations actually have taken OR groups into their managerial fold.

Right now, SKF Industries, Lockheed Aircraft Corp., Sun Oil Co., Bell Telephone Laboratories, U. S. Rubber Co., Atlantic Refining Co., among others, have formed OR groups or are represented on the membership roll of the new society.

Many companies have called on outside OR teams to work out problems for them. Unfortunately, not many OR groups are available for hire. Arthur D. Little, Inc., and E. H. Smith & Co., Silver Springs, Md.,

are apparently the only commercial firms with teams for hire. Columbia University, Case Institute, M.I.T., Battelle Institute and Armour Research Foundation also have teams which probably will be called upon by industry until more commercial units are formed.

Not long ago, a well known chemical company that operates 20 plants in the Northeast and Midwest called on Arthur D. Little's OR group to straighten out their inventory troubles. Operations in many divisions alternated between extra-shift production and shutdown because of seasonal fluctuations in sales. Everyone in the company agreed that the scheduling was terrible, but few agreed on how to improve it.

The company's treasurer complained that inventories were too high, cost the company too much money. But sales and production managers objected strongly to any arbitrary decision to cut inventories.

The general manager knew that a firm inventory policy was needed. But he believed that his assistants lacked real knowledge of all the significant factors and that outside help should be sought. Within a short time the ADL team came up with the answer, obtained by a technique known as calculus of variations. The resulting company-wide savings in inventory costs are about \$225,000 per year.

► **Problem of Definition**—Operations research is a simple, convenient term applied to a technique difficult to define. Even OR people themselves cannot fully agree on an exact definition. But no doubt, as operations research sees more use, it will find its own limits and meaning, and eventually define itself.

From the service it has seen so far, Arthur Brown, executive secretary of the Committee on Operations Research for the National Research Council, has recently come up with this definition: "Operations research," he says, "is the application of the scientific method, by an operations research group, to the study of the environment and operations of an organization and to the determination of the basic laws of operations in order to improve the effectiveness and efficiency of the organization in carrying out its basic purposes."

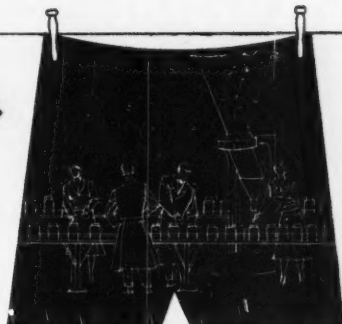
As in any kind of research, OR must begin with first-hand study of the raw material—in this case, operations, which means the day-to-day activity of the organization being studied. Like all fundamental research, its aim is to understand how the world works; unlike most fundamental research, it works primarily with probability functions rather than physical laws.

Also unlike fundamental research, its final aim is to do, rather than to know; it has its eye on the practical goal of applications. It tries to uncover the basic laws applicable to a specific operation. With these, the OR man can predict the course of future operations, and modify present

There's no limit

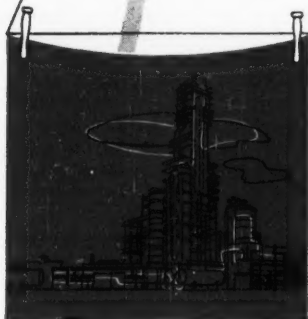


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Alcoa Chemicals



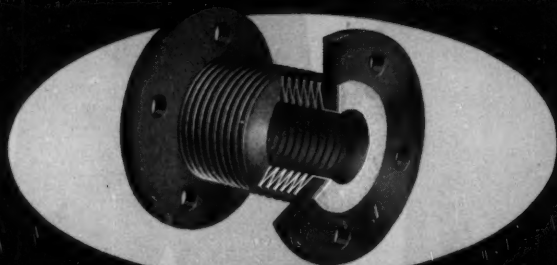
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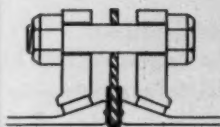
CHEMISEAL

MADE OF
TEFLON

Expansion Joints, Gaskets
and Accessories for Glass Pipe

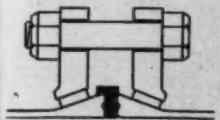


ACID, CAUSTIC, SOLVENT RESISTANT

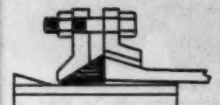


(Above:) Chemiseal Expansion Joints, No. 212 for use where thermal expansion, vibration or misalignment requires a flexible pipe section. Sizes from 1 in. to 12 in. I.P.S.

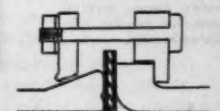
(At left:) Chemiseal Jacketed Gaskets, Types T6N or T6-300, standard for Corning conical flanges, seal at low bolt loads.



Chemiseal Snap-on Type 820 Gaskets. Molded to match contour of conical glass pipe, they assure perfect automatic centering of joints and free flow of materials. Made for all standard pipe sizes from 1/4 in. to 6 in.



Chemiseal Jacketed Slip-joint Gaskets (Teflon-jacketed Neoprene) provide positive, chemical-proof seals with low bolt loads. Made for standard pipe sizes from 1 in. to 6 in.



Chemiseal Adaptors No. 2-CRS, provide a tight, safe seal between glass coated steel or similar nozzles with large inside radii, and vessels of glass-lined steel, porcelain, Havg, etc. Easy to handle, single units—these adaptors combine a steel bearing ring for rigidity, and a resilient core for perfect seal—both contained in a chemically inert Teflon Jacket.

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*DuPont's trademark for its tetrafluoroethylene resin

News, cont. . .

operations to produce new or better results.

The Power of Mathematics—Chief tool of the OR man is mathematics, including statistical analysis and probability theory. With it he organizes his data into usable form, and from his final equations he can draw mathematical conclusions covering a wide variety of cases.

Suppose a chemical manufacturer wants to find out the best location for his new plant. He can't solve this problem experimentally; that is, he obviously can't afford to build and operate test plants in several different locations.

Usually, he will select a reasonable number of possible locations by qualitative policy decisions. His engineering staff will then make estimates of operating costs at these potential sites and pick the one showing the lowest cost or highest return on investment.

► **Building A Model**—To pick the ideal location, an operations research man would go back to the experimental approach. But the plants he builds and operates are all on paper, in the form of one or more mathematical equations. These equations, known as mathematical models, express in the simplest possible terms the proper relationships between all the factors bearing on the problem.

By inserting test values of the variables—say, for example, the cost of electric power, or the standard of living of the labor force, it is possible to study scores of potential locations with quantitative precision. Because the mathematical models are usually complex in such a wide problem as this, it may be economical to make use of digital or analogue computers to speed up the work.

In many cases, even when the models cannot be built on firm knowledge—for lack of time to do the basic research, perhaps—it may be possible to make real headway by pooling the knowledge of specialists from many fields. Then the OR man would build up his model by calling on experts in labor relations, transportation, civil engineering, and by working with someone who knows the company's business and engineering policies.

In this case, data will be collected after the model is built. When the facts are in, it is necessary to agree on their weight and importance.

The equations will be as reliable as the assumptions on which they are founded. If the work has been skillfully done, and the experts have been right in their estimates, the results will be sound. These methods have been used by several consulting OR teams since the end of the last war with excellent results.

► **Military Origin**—Operations research got its real start during World War II. At one time, Naval operations officers worried about our sub-hunting planes. Considering the number of subs they spotted, the U-boat sinking score was quite bad—much lower, the officers thought, than it should be.

Unable to find out why, the Navy called in a group of research scientists, principally mathematicians and physicists, and asked them to study the facts. This team, eventually called an operations research group, made a detailed analysis of the number of German subs that submerged before a plane that sighted them could attack. It turned out that 40 percent remained on the surface.

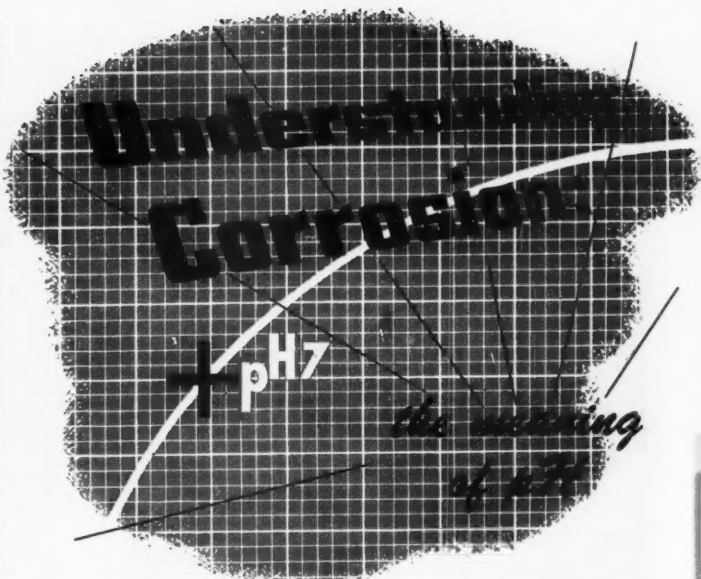
Because this was an unexpectedly high figure, they suggested a change in armament for the planes. The planes, they said, should be armed primarily to hit surface subs. Soon shallow depth charges and rockets were installed on the sub-hunting planes. The shallow charges alone increased sub sinking by 50 percent.

Since 1945, the Defense Department has set up operations research groups in all major branches of the armed forces. Teams today are working out such tactical and strategic problems as night bombing and propaganda warfare in Korea, as well as formulating quantitative data to guide possible future military decisions.

► **Career Opportunities**—According to Professor David Hertz of Columbia University, an OR man should be receptive to new information, flexible, intellectually curious, able to formulate problems, able to put information together in many ways, experienced in a scientific field and able to work with others. Ideally, he should be the strange combination of theoretical physicist, Philadelphia lawyer and Rotarian.

"The one indispensable item, however, is the desire and ability to do research. I do not believe that OR can be learned by those who do not have the native talent for it," Arthur Brown says.

To get into operations research



A governing factor in establishing the rate and extent of corrosive attack of a solution on metal is the determinant of acidity or alkalinity — hydrogen-ion activity. This factor is identified by the symbol pH and measured on a scale on which readings of less than pH 7 indicate acidity and more than pH 7, alkalinity. Intensity either of acidity or alkalinity exerts a primary influence on the tendency toward corrosion, with severity of corrosive attack at its greatest in the acid zone and generally decreasing as alkalinity increases. Variations in pH further alter the degree of influence of other factors in corrosion. The nature of corrosion products, for example, may be affected, thus changing the character of the resulting protective film and rendering such a film formed in the neutral or alkaline zone more effective than one formed in the acid zone.

Consideration of pH as it affects and is affected by other determining factors is essential to proper evaluation of any corrosion problem. Understanding and assessing the relative importance of this and of all factors involved is Dampney's first approach to a preventive or corrective program — an approach that forecasts with exceptional accuracy the ultimate success of the coating system selected.

In the production of chemicals, food, petroleum, textiles — wherever power and processing needs create difficult or unusual corrosion problems — you will find Dampney *equipment-engineered* coatings performing most satisfactorily. Whether your corrosion problem involves diesel engines or fume-carrying ducts . . . steam turbines or corrosive-handling tanks . . . Dampney knowledge and experience can help you. We invite you to call upon it freely.

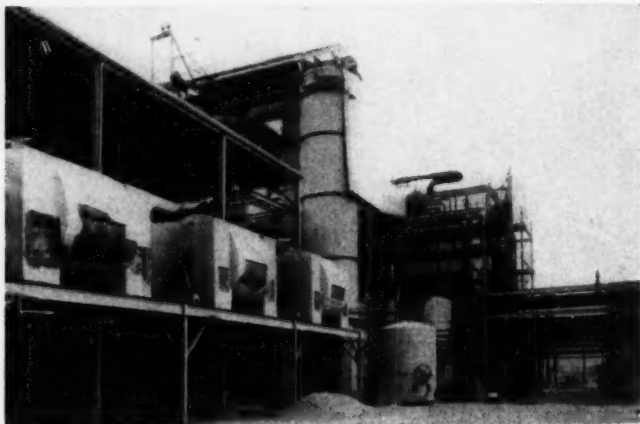


HYDE PARK, BOSTON 36, MASSACHUSETTS

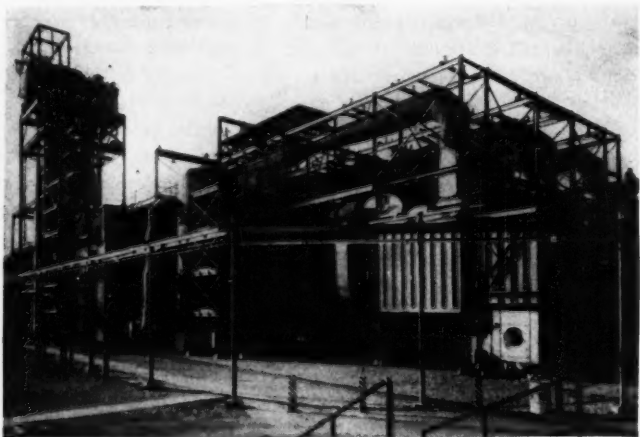
work, an engineer would have to take courses (probably enough for an M.S. degree) in advanced engineering statistics, mathematical forecasting, industrial probability, theory and models in organization, linear programming, statistical quality control and servomechanisms. Most courses are given, or will be given, at Columbia or Case.

The operations research group is usually considered a part of the management staff. The top OR man may report to the president or the executive vice president. Or if the OR thinking is restricted to problems of production, the OR director may report to the vice president in charge of production.

How much does an operations research man make? There are no available data for salary surveys. However, pay scales in the government range from about \$6,000 for green Ph. D.'s untrained in OR to about \$15,000 for the top men. Top operations research men in industry are paid as high as \$40,000.



CHLORINATION of benzene, using hydrochloric acid and oxygen, is first step.



HYDROLYSIS of monochlorobenzene with steam yields crude phenol for purification.

Two Steps to More Phenol

Completion of the new Marietta, Ohio, plant of Bakelite Co. steps up the nation's phenol capacity by one-fourth. The new plant can produce 60 million pounds a year of phenol.

It uses a two-step process, starting with benzene, hydrochloric acid and oxygen.

Bakelite will produce phenol from benzene by a process that is basically

one of conversion, separation and purification. It is a cyclic process.

In the first of the two main reaction stages in the continuous process, monochlorobenzene is formed by the reaction of benzene, hydrochloric acid and oxygen in converters. Only part of the materials is converted to the required product in each stage, so both the intermediate and final products must be processed in separation and refining equipment.

Next, the monochlorobenzene is hydrolyzed with steam from superheaters and converted to phenol in the second stage conversion system. The phenol is separated and purified in a separation column and caustic scrubber before it is ready for use.

Of the outdoor design so successful in the petroleum industry, the plant has processing equipment erected around a single control building from which the chemical reactions are directed.

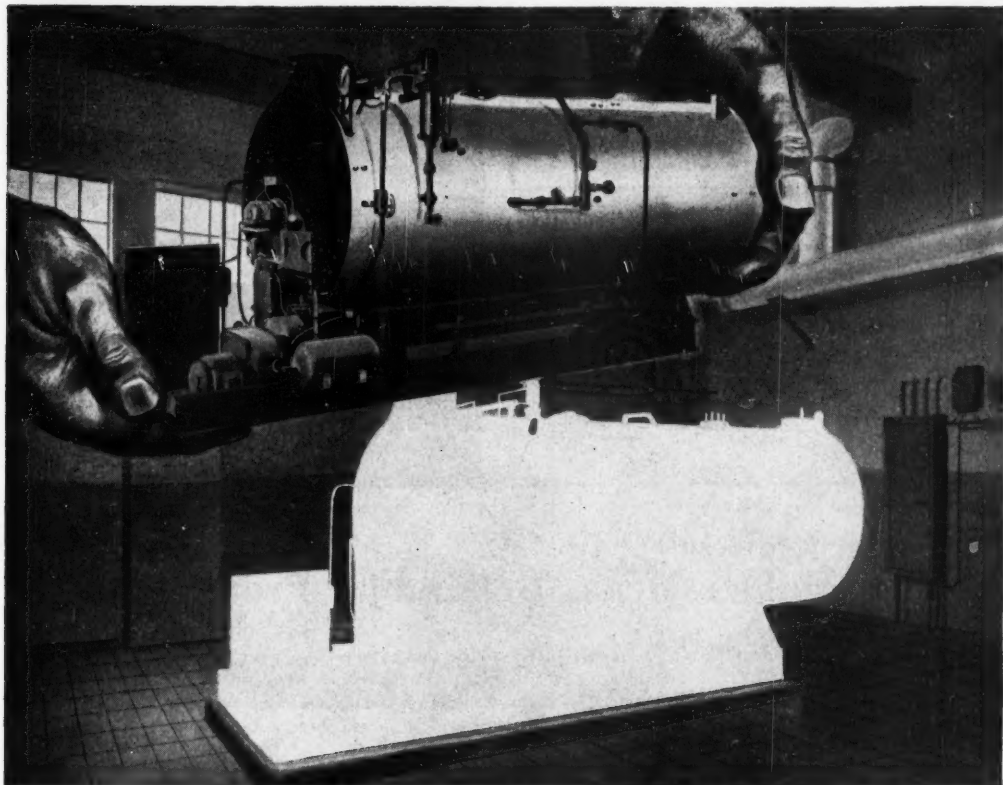
Tanks of 1½ million gallons capacity each store benzene shipped to the plant in tank cars and Ohio River barges.

The Marietta phenol plant draws all its power and steam from the adjacent plant of Electro Metallurgical Co., another division of Union Carbide & Carbon Corp. One of the largest of its type in the world, this plant has four new 40,000-kw. turbo-generators used in making ferro-alloys.

In its new phenol plant, Bakelite was able to use as materials of construction its own phenolic resins to impregnate glass fiber mat for use as insulation around ducts.

Phenol is in growing demand, especially for phenolic resins used more and more in such new processes as production of thin-shell foundry molds, wood aggregate cores, honeycomb structures and large-size molded pieces. The new Bakelite plant is expected to stimulate greater use of phenolic plastics.

Ready when you need it...



Save Installation-Construction Time — Expedite Emergency Installations — Serve Immediate Temporary Steam Needs — With a Cleaver-Brooks Self-Contained Boiler

WHEN speed is vital, you can save weeks of valuable installation time with a Cleaver-Brooks boiler — delivered to location as a complete, factory assembled and tested, self-contained unit, with much of the trim and accessories provided.

In an emergency the installation time can be reduced to as little as 48 hours, by following a properly planned and coordinated procedure of providing in advance the required facilities — foundations, headers, service and blow-off lines, fuel tanks and lines.

Prior to the completion of your building, Cleaver-Brooks boilers can be placed in operation to serve immediate steam needs. When permanently installed the change-over takes

place with a minimum of labor and expense and the avoidance of interrupted steam service.

Cleaver-Brooks are the first and finest in modern, self-contained boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 250 psi.

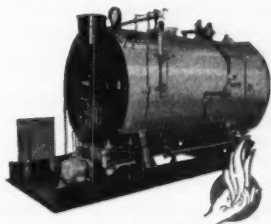
CLEAVER-BROOKS COMPANY
Originators of the Self-Contained Boiler
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Cable Address: Clebro-Milwaukee



Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler Catalog.

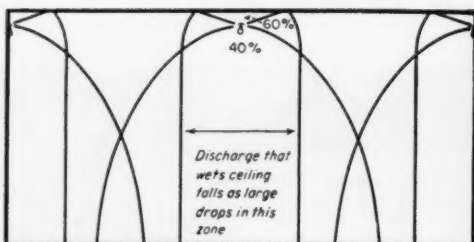
WHY INSTALLATION TIME IS CUT:

- ✓ Simple Low-Cost Stack
- ✓ No Job-Site Brickwork — No Special Foundations
- ✓ Boiler Delivered as a Complete, Factory Assembled, Tested, Self-Contained Unit
- ✓ Centralized Responsibility — No Waiting on Multiple Sources of Supply

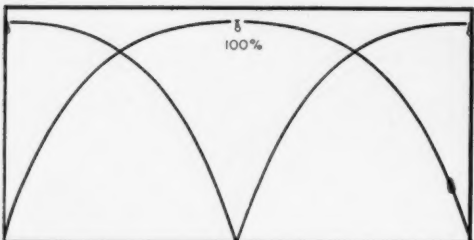


Cleaver-Brooks

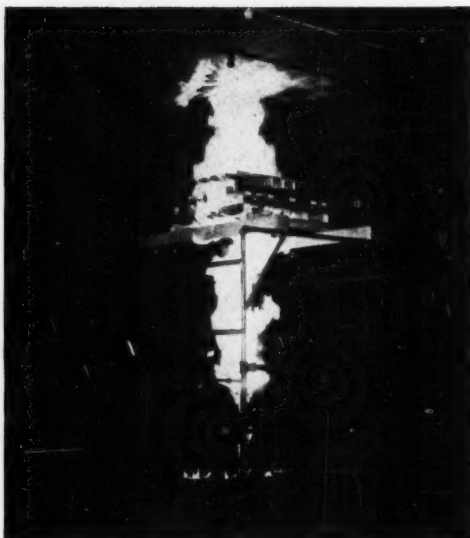
Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners



OLD: Conventional upright sprinkler heads work like this.



NEW: Now upright spray sprinkler works like this.



WHY: Spray heads tested under actual fire conditions.

New Sprinkler Means Better Fire Protection

A new development in automatic sprinklers promises to make this dependable fire protection method even better.

► **New Concept**—The development comes in the form of an improved type of upright sprinkler head which works on the wide-angle discharge principle. Fire protection engineers have concluded in recent years that sprinkler heads with a downward wide-angle discharge do a better job in fighting fires than the conventional sprinkler which sprays 60 percent of the water up on the ceiling (see cuts).

Until recently, however, the only available type of sprinkler head that worked on this principle was the pendent type. These heads are attached to the underside of a pipe upside-down fashion (hence the name). Their chief disadvantage is this: Inasmuch as most existing sprinkler systems were installed using the conventional (upright) sprinklers, replacement with the pendent type means raising and rearranging the sprinkler piping.

Besides, pendent head systems cannot be thoroughly drained as a precaution against freezing weather.

Obviously, it would be much more

practical to design a good upright head that worked like the pendent heads; then replacement in existing piping would be cheap and easy.

► **New Sprinkler Head**—Research engineers at the Factory Mutual Laboratories at Norwood, Mass., have now done just that. Working in large-scale, modern facilities, where actual fire conditions can be simulated, these engineers, under the direction of Norman J. Thompson, have designed and proved an experimental model of an upright sprinkler head with a wide-angle discharge pattern.

One sprinkler manufacturer has the new head in production but expects to be snowed under by demand for quite a while.

Most of the other manufacturers are busy working on commercial models of the experimental head developed by F. M.

These new spray sprinklers are worth investigating, for several reasons:

- First, they can replace present standard heads in buildings where the fire hazard approaches the limit of existing sprinkler capacity or where the water supply is barely adequate.

- New sprinkler installations can be made at substantially lower cost if the

new heads, in ordinary orifice size, are spaced farther apart. This allows a greater protected area per head—about 25 to 33 percent more.

- There seems to be no good reason why sprinkler lines cannot be run at right angles to beams in narrow bay mill construction.

- Since the new spray sprinklers have a much wider distribution pattern, or a longer lateral reach, than the present standard type, there is a good chance that they might stop a slowly spreading fire with a lesser number of heads opened than the standard type with its more restricted distribution. For the same reason there will be water discharged onto a fire beneath a plugged head on account of the distribution range of surrounding heads.

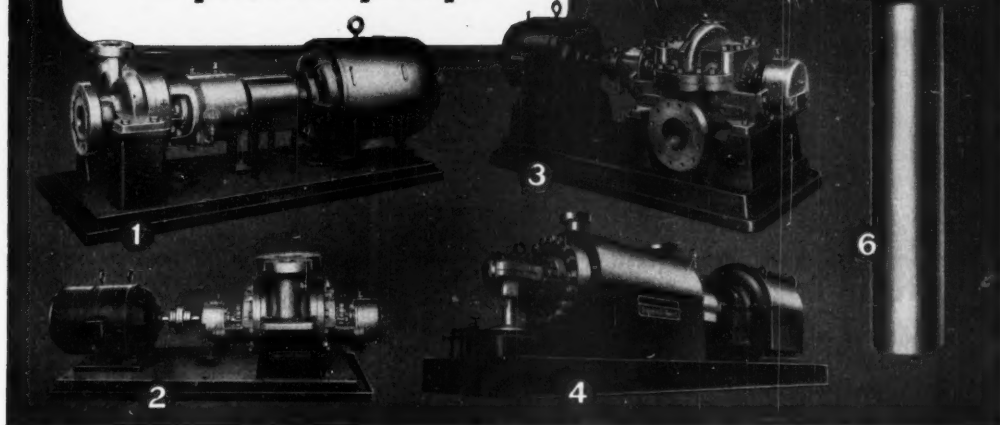
► **Well Tested**—The new heads have been thoroughly tested under many different types of industrial construction in comparison with typical sprinklers of conventional design.

One example is a standardized fire test under smooth wood plank ceilings.

Here a combination of a gasoline spray at different rates of flow is allowed to burn under a wood crib of 2 x 4 and 4 x 4 Douglas fir planks.

6 ANSWERS

*to the demand
for real economy
in process pumps*



These six types of

Ingersoll-Rand process pumps

offer you important savings

For most applications, there's an Ingersoll-Rand pump that is right for the job. This means more than just meeting design conditions—it means construction of the right materials and the right sealing arrangement, with either the Cameron Shaft Seal or an adaptation of a packed stuffing box.

Let your nearest I-R representative give you the details on the real economy of I-R pumps—through their high sustained efficiency, economical operation, and low maintenance.

	PUMP TYPE	STAGES	CAPACITIES	HEAD
1	Vertically split with top (or bottom) suction and discharge or end suction and top discharge	Single stage	20 to 3200 gpm	Heads to 600 feet
2	Vertically split with top suction and discharge	Single stage	250 to 3500 gpm	Heads to 1100 feet
		Two stage	200 to 1200 gpm	Heads to 1100 feet
3	Horizontally split with side suction and discharge	Single stage	30 to 2300 gpm	Heads to 750 feet
		Two stage	170 to 1300 gpm	Heads to 1100 feet
4	Diffuser type with "double-case" construction. Top suction and discharge.	Multi stage	450 to 3000 gpm	Heads to 6000 feet
5	Vertical pump, diffuser type	Multi stage	20 to 400 gpm	Heads to 4800 feet
6	Vertical pump, turbine type	One or more stages	60 to 35,000 gpm	Heads to 150 feet per stage

Compressors • Air Tools • Rock Drills
Turbine Blowers • Condensers • Centrifugal Pumps
Diesel and Gas Engines

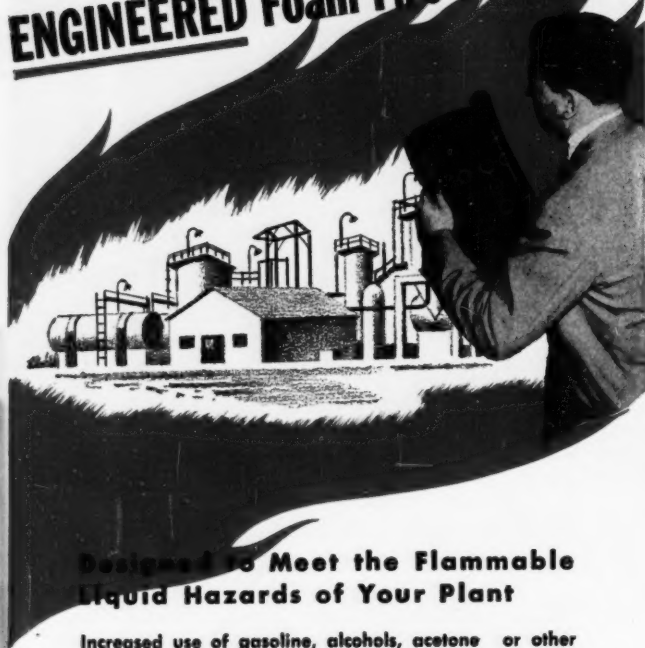
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Designed to Meet the Flammable Liquid Hazards of Your Plant

Increased use of gasoline, alcohols, acetone or other flammable liquids creates serious hazards you may have overlooked in your plant. Check your present protection facilities now so you can meet sudden emergencies with fast, positive, fire-killing foam.

National Foam engineers can survey your plant, study risks involved, and then determine the type of foam protection best suited to your plant's requirements . . . mechanical or chemical foams . . . the most complete choice of devices available . . . Foam Chambers for large tanks, Overhead Spray Deflectors, Nozzles, Dip Tank or Drain-board Systems, or even small extinguishers and other devices . . . whichever is best suited to your particular needs. Large plant, or small, National Foam specialists are ready to engineer foam protection to meet the hazards of your plant.

Let National Foam engineers and chemists show you how to get the best foam fire protection today! Consult your nearest National Foam Distributor, or write us direct about your problem.

NATIONAL

FOAM SYSTEM, INC.

Headquarters for Foam Fire Protection
WEST CHESTER, PENNA.



In this test the new spray sprinkler was compared with standard heads operating at pressures of 5, 15 and 33 psi.; and each test was continued for 30 minutes. The fire was located 8 ft. below the sprinkler heads but at various locations laterally with respect to the heads.

For comparison, the new spray sprinkler was operated in each case at lower pressures to reduce the water discharge rate 25 percent below that of the standard heads.

Test criteria were the damage to ceiling, the actual weight loss of the crib, maximum sustained ceiling temperature for 5 min., and the total resulting water flow from the number of automatic heads which opened.

► **Better Protection**—On the average, destroyed ceiling areas were reduced from 14 sq. ft. to 0, the crib weight loss from 160 lb. to 43 lb., the ceiling temperatures from 1,200 deg. F. to 800 deg. F. or less, and the total water flow reduced from 252 gpm. to 192 gpm.

In general, test results under other conditions were comparable to the tests under smooth wood ceilings.

It all adds up to a substantial victory in the never-ending battle against the ravages of industrial fires.

Recovered Sulphur Shipped Molten From Extraction Unit

Its second sulphur recovery plant in West Texas was recently put into operation by Phillips Chemical Co. The plant, located next to the Crane gasoline plant of Phillips Petroleum Co. in the Permian Basin oil fields of Crane County, is designed to extract 100,000 lb. of sulphur per day from natural gas. Production has already exceeded design capacity by over 10 percent.

Sulphur from this plant will not be solidified. Instead, it will be trucked in its molten state to a railroad spur 38 mi. away where it will be loaded into tank cars for delivery to its ultimate destination.

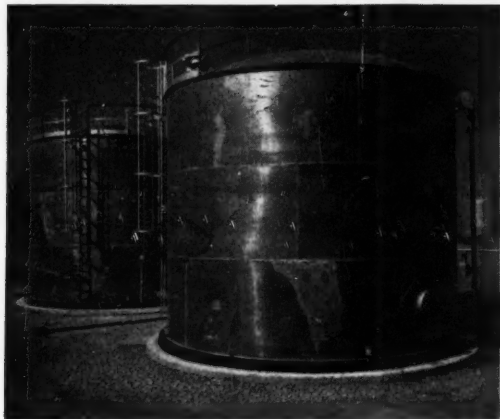
Present plans call for output of this plant to be converted into sulphuric acid. The acid will be used to manufacture ammonium sulphate at the Adams Terminal plant of Phillips Chemical near Houston.

Production from a similar plant near Goldsmith, Tex., began in February.

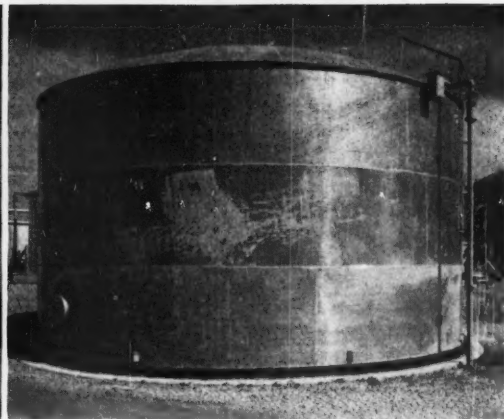
HORTON TANKS

Made of

ALUMINUM



Two 50,000-gal. Horton flat-bottom aluminum tanks used to store propionic acid. Both have umbrella roofs.



One of three 120,000-gal. Horton flat-bottom aluminum tanks used to store acetic acid. All have umbrella roofs.

STORE PROPIONIC and ACETIC ACID

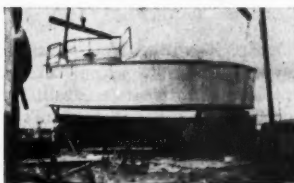
U. S. Industrial Chemicals Co. Division of National Distillers Products Corporation installed five Horton aluminum tanks at their Brownsville, Texas plant for the storage of propionic and acetic acid. Both acids are synthetic chemicals produced during the manufacture of hydrocarbon liquid fuels from natural gas. Propionic acid is employed in products for the plastics, surface coating, food and pharmaceutical industries. Acetic acid is used in the manufacture of cellulose waters for plastics, films, lacquers and yarns.

Chicago Bridge & Iron Company's experienced engineers, shops and field crews have designed, fabricated and erected many aluminum and stainless steel corrosion-resistant tanks for the chemical industry. The installations shown here are typical. Whatever the need, we have the facilities and the skill to fabricate and erect the equipment you require.

Investigate our facilities the next time you plan use of corrosion-resistant materials. Write our nearest office for information or quotations.



Assembling the umbrella roof and first ring of one of the USI aluminum tanks.



Hoisting the roof and first ring of the tank shell off the ground while the second ring is assembled.



Two aluminum tanks near completion and a third being erected in the background.

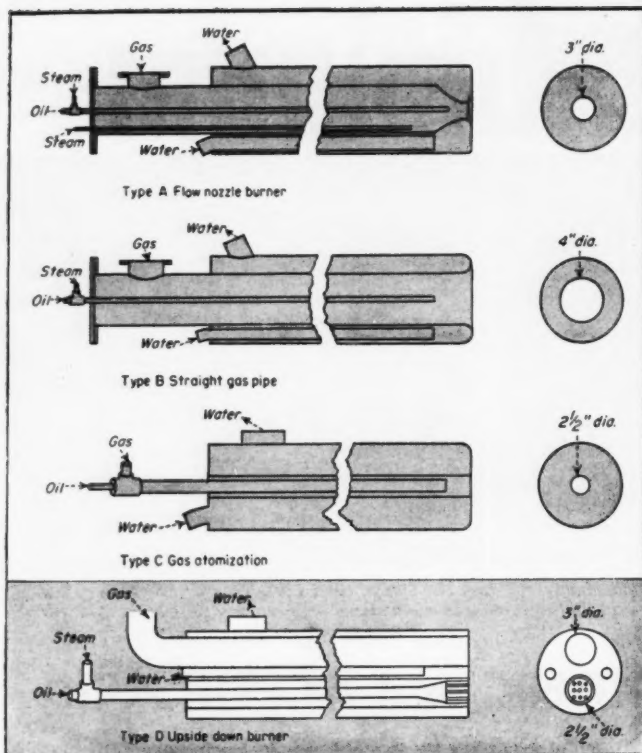
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Los Angeles 17.....1505 General Petroleum Bldg.
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Philadelphia 3.....1625-1700 Walnut St. Bldg.
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Seattle 1.....1305 Henry Bldg.
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FOUR FOR ONE: First three burners were unsuccessful; bottom one was adopted. . .

Solving Dual-Fuel Problem

Water-cooled burner handles up to 70 percent coke oven gas simultaneously with oil or tar to fire an open hearth at temperatures up to 2,300 deg. F.

Chemical engineers today are facing more and more problems in high-temperature technology. Often the process man finds that the solution to a problem in his precincts is indicated by one of the problem-solution reports of engineers in a sister industry—like iron and steel.

One problem both industries face is the proper design of fuel burners to attain effectively a high-order temperature. The difficulties are compounded when you have to burn mixed fuels, as often happens when the plant must dispose of a byproduct gaseous fuel most economically.

► **Steel Men Did It**—Bethlehem Steel Co. faced and solved such a problem

at its Sparrows Point, Md., plant. The job was to burn 70 percent coke gas in an open hearth with no loss in production. To do this, Bethlehem's research department designed a special water-cooled burner. To date, results from burning high percentage coke gas have been even better than expected and production has actually increased with the gaseous fuel. In fact, engineers at Sparrows Point found that desulphurized coke oven gas, combined with tar, made an ideal fuel.

J. H. Kelley, assistant superintendent of the Open Hearth and Bessemer Department of the plant, has prepared a detailed report* on this development.

► **Wasn't Easy**—Setting out to design an efficient burner was not easy, since coke gas in an open hearth had the reputation of producing foam, riding the roof and producing a general headache.

► **First, Clogging**—The first burner tried consisted of a central, steam-atomizing, liquid-fuel burner terminating immediately back of a flow nozzle for gas (see cut). The object of the flow nozzle, of course, was to conserve pressure energy, and this burner actually operated with a lower gas pressure than any of the others tried.

Flame characteristics were good also. In spite of these advantages, however, this design was discarded—the burner clogged from deposits forming in the gas pipe behind the flow nozzle.

► **Second, Flame Spreading**—In the second burner design an attempt was made to get away from the clogging problem by eliminating the nozzle. This burner consisted of a straight 4-in. gas pipe extending the full length of the burner, with a liquid-fuel pipe extending along its center to a point near the furnace end of the burner. With this design, the normal flame had a tendency to spread too much. Disappointingly enough, deposits still caused trouble, affecting gas flow and flame direction.

► **Third, Poor Flame Control**—Next, Bethlehem's engineers tried atomizing oil with coke gas. Here, they hoped to save money by eliminating steam and, at the same time, using the steam lines to handle gas. They also hoped that by substituting a combustible gas for an inert atomizer, a hotter flame per unit of fuel could be developed. The engineers felt that these possibilities would offset the increased cost of compressing coke gas.

In tests, they varied the gas pressure from 25 to 100 lb., using burner tips from $\frac{1}{8}$ to $1\frac{1}{2}$ in.

But the experiment proved that atomizing oil with coke gas could maintain, at best, only 35 to 45 percent gas, was hard on compressors, and gave a higher refractory consumption.

► **Fourth, Success!**—The research engineers finally decided that one practical way to avoid clogging of the gas pipe and excessive atomization of the

* Presented before the general meeting of the American Iron and Steel Institute in New York a few months ago. This report covered the details of furnace operation, as well as burner design.

liquid fuel would be to separate the liquid fuel and gas pipes. Besides, with gas at adequate pressure to provide a high enough gas velocity at the burner tip, they found that the gas stream could be put above the liquid fuel stream.

After they tried different sizes and arrangements, a 3-in. gas pipe over a nine hole Fisher oil tip turned in the best over-all performance and is now standard on all furnaces for combination coke gas and liquid fuel.

They've tried to go to larger gas pipes to cut gas compression costs and to smaller gas pipes to decrease burner cooler size, but in each case performance was poorer. A larger gas pipe and a flow nozzle cannot be used in Bethlehem's case because of limitations on burner cooler size.

The burners are installed in two of the open hearths at Sparrows Point. Each furnace has a burner at either end operating on 15 min. alternating cycles. Each burner has a rated capacity of 90 million Btu. per hr., can burn up to 135,000 cu. ft per hr. of coke gas in combination with liquid fuel. Standard operation, though, calls for 80,000 to 90,000 cu. ft. of gas per hr. per furnace.

► **Wider Applications?**—To date, most furnaces outside the steel industry do not require a water-cooled gun, since normal air temperatures coming through a standard industrial burner are 500-600 deg. F. On the other hand, those in open hearths get up to 2,000 deg. F. and higher.

But, as we said, this type of burner might be just what somebody in the chemical process industries has been looking for.

Process Eliminates Aging In Making Ammoniated Super

Stauffer Chemical Co. has acquired exclusive American rights to a new process for production of ammoniated superphosphate. The process, developed by Rumianca, Societa Per Azioni, Turin, Italy, produces a pelleted product containing nitrogen and phosphorus in amounts that can be varied over a wide range to meet specific requirements.

About the same proportion of phosphate is water-soluble in the product made by this process, according to Stauffer, as in single superphosphate.

The product can be bagged or shipped without the aging period usual in superphosphate manufacture. This

NEW USES FOUND FOR UNIQUE PROPERTIES OF METALLIC OXIDE PIGMENTS



Product Planning



Product Improving

You ordinarily think of metallic oxide pigments being used to produce coloring agents, catalysts, polishing agents and magnetic materials.

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Below is a review of their characteristics. Look them over. You may get the germ of an idea which will lead to the improvement of existing products . . . or to the reduction of new product manufacturing costs.

Should an application suggest itself, write. We'll be glad to cooperate with you in exploring the possibilities. Address Dept. 3, C. K. Williams & Co., Easton, Penna.

Name	Properties	Characteristics
Pure Red Iron Oxides and Indian Reds	Fe_2O_3 -98.5% SpG.-5.15 Color—Salmon to purplish red	Composition: The basic colors of the iron and chromium oxides are determined by chemical composition. Reds are ferric oxide (Fe_2O_3); yellows, hydrated ferric oxide ($\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$); blacks, ferro-ferric oxide (Fe_3O_4); and greens, chromic oxide (Cr_2O_3). All these compounds are chemically stable and light permanent. Particle Shape: Physical properties such as oil absorption and suspension characteristics are dependent on particle shape, controlled by manufacturing processes. Size: Color range is controlled by particle size—average size increases as color darkens. Uniformity of size determines brightness. Purity: Freedom from impurities is essential for superior pigment properties and to prevent deleterious effects in end-products. Control of soluble salts, manganese and copper content are an important part of the Williams' manufacturing operation.
Pure Yellow Iron Oxides	$\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ -99% SpG.-4.03 Color—Lemon to dark orange	
Pure Black Iron Oxides	Fe_3O_4 -96% min. SpG.-4.96 Color—Blue Black	
Pure Chromium Oxides (and Hydrates)	Cr_2O_3 -99% SpG.-5.20 Color—Light to dark green	
Natural Oxides—Ochers, Umbers, Siennas, Metallic Browns, Red Oxides	Wide range of ferric oxide content and red, yellow and brown colors	
Venetian Reds	Fe_2O_3 -40% SpG.-3.45 Color—Light to medium red	
Cuprous Oxide	Cu_2O -97% min.	
Extenders—Barytes, Calcium Carbonate, Calcium Sulfate, Silica	Wide range	

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NEWS, cont. . .

reduces the cost of a plant by eliminating storage facilities for curing single super. Capacity of present plants could be enlarged by use of this process without the need for additional storage.

Raw materials are the same as in standard processes—phosphate rock, sulphuric acid and ammonia. Stauffer plans to sublicense the Italian process to other U.S. producers.

Flow of Liquids in Spheres Aids Nuclear Reactor Design

How does a liquid move in a sphere? To find out, Carbide & Carbon Chemical Co. has granted a \$35,500 contract to University of Tennessee chemical engineers. The answer could affect design of nuclear reactors.

The grant is for continuation of research supported by Carbide & Carbon, prime contractor for AEC at Oak Ridge. Professor H. J. Garber and Fred N. Peebles are directing the research for the University of Tennessee.

During the past year, engineers at the university in Knoxville have investigated the movement of water rotating at high speeds in spheres, measuring pressures developed, and working out techniques for visualizing liquid flow patterns. The new contract will enable them to continue experimental work, interpret results and relate them to reactor design.

Dr. R. M. Boarts, chemical engineering department head, is general supervisor of the project. The University of Tennessee researchers are working closely with Dr. C. E. Winters and C. B. Graham of Carbide's reactor experimental engineering division at Oak Ridge.

New Evaporator Will Reduce Pollution by Sulphite Liquor

Installation of Wisconsin's first commercial-scale evaporator for concentrating spent sulphite liquor is more than half completed at the Rhinelander, Wis., mill of Rhinelander Paper Co.

Estimated cost of the unit is \$350,000. It will help to reduce pollution in the Wisconsin River.

Scarcity of stainless steel has delayed fabrication of the equipment, which was ordered two years ago. Now, however, all but one of the four

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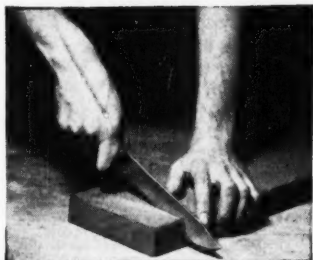
For additional information write
to your MPC representative or to
our Application Engineering Dept.

*Saran Rubber is a development
of the Dow Chemical Company



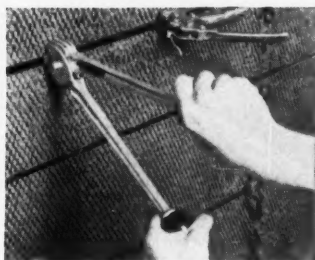
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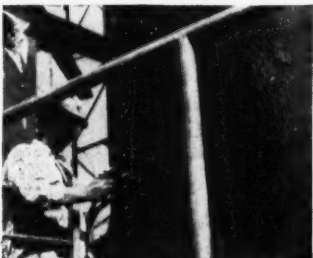
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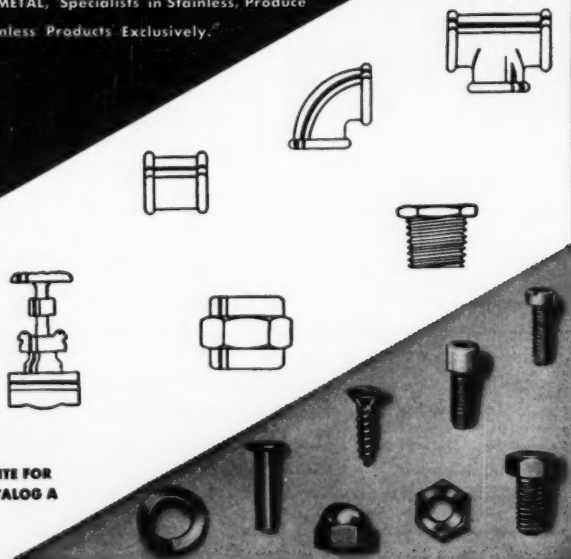


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NEWS, cont. . .

evaporator bodies have been delivered. For a time the recent steel strike delayed completion of the fourth body, but it should soon be in place.

Meanwhile, Rhinclander has been installing as much of the equipment as has already been received. The company plans to start trial runs this month.

Thirteen other operators of sulphite mills in Wisconsin will be kept informed on results and technical data when the new evaporator actually goes to work. Like Rhinclander, these other companies are members of the Sulphite Pulp Manufacturers' Research League. Information on the Rhinclander operation will be used by other members of the research group in design of their own pollution-abatement plants, currently in various stages of completion.

Financing Completed for Dicalcium Phosphate Plant

Texas City Chemicals, Inc., organized a year ago to build a chemical plant at Texas City, has completed financial arrangements. The First National Bank of Dallas transferred \$6,966,900 to the company. About \$3 million will come from the sale of stock by Glore, Forgan & Co., about \$1 million will be put up by officers and directors of the firm, and a further \$3 million loan will be handled by the First National Bank of Dallas and the City National Bank of Houston.

President of Texas City Chemicals is R. L. Wheelock of Corsicana, Tex., and chairman of the board is W. L. Pickens of Dallas. S. A. Winfrey of Dallas is a vice president, E. H. Kiepf of Dallas is vice president and general manager, and H. H. Coffield of Rockdale is secretary-treasurer.

Ground was broken for the plant in March 1952, but little progress has been made in construction while awaiting completion of these financing arrangements.

It is now expected that the \$5,296,000 plant, being constructed by Chemical Construction Corp., will be completed early in the summer of 1953. High priorities for equipment were allotted to Texas City Chemicals because the plant will extract uranium from the phosphate rock and sell it to the Atomic Energy Commission.

Plans calls for the production of

more than 70,000 tons a year of dicalcium phosphate by treating the rock with spent sulphuric acid from the neighboring plant of Carbide & Carbon Chemicals Co. About 200 tons a day of reformed acid will be returned to the Carbide & Carbon plant, and the rest will be sold. The new plant of Texas City Chemicals will also produce 4,000 tons a year of sodium silicofluoride.

Latex: The chemical division of General Tire & Rubber Co. has expanded facilities at Akron, Ohio, for the manufacture of vinyl pyridine latex. It improves the adhesion between rubber and rayon or nylon.

Solvent Extraction: The new \$500,000 extraction plant at Wonder Rice Oil Co. at Houston, Tex., is now operating. It can handle 100 tons of rice bran a day, producing 30,000 lb. of crude oil. Allis-Chalmers Manufacturing Co. designed the plant, which uses a continuous solvent extraction process.

LITTLE BONER

Loose Bolts

The night-shift operator was shocked by a sudden knock in the big compressor. He stopped it and called the plant engineer (who mumbled profanely about the troubles that always happen at night).

The engineer arrived in a sour mood, looked the compressor over, decided something was wrong with the crank pin bearing. The connecting rod was dismantled—nothing wrong with the crank and wrist pin bearings.

Then the bearings were adjusted, assembled and a test run made. The knock was still there.

Now confused, the engineer told the maintenance man to change crankcase oil with a premium grade. The knock seemed worse than ever.

"To hell with that knock," he muttered, and told his men to take a 10-minute break while he studied the blueprint of the stripped unit.

While he was doing that one curious mechanic put his wrench to one of the bolts holding the flywheel in place. The bolts were loose and the flywheel hub was riding on the key.

When the engineer came back he was stunned to find the compressor running smoothly. He had gone to so much trouble to disassemble the unit when all the while the flywheel bolts were loose!

This "little boner" happened in a chemical plant in the Philippines. If you have a true little boner, why not send it to the Editor, Chemical Engineering, 330 W. 42nd St., New York 36, N. Y.

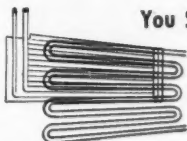
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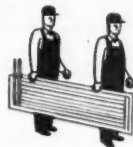
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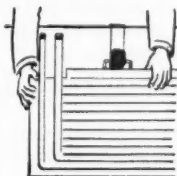
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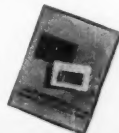
Weighing only about half as much as equivalent pipe coil, Platecoil is easy to handle. A whole maintenance crew is not needed to transport and install it.



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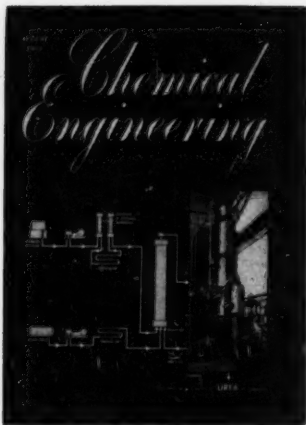
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Readers' Views & Comments



Urea: Inventa Process

Sir:

Your August issue of *Chemical Engineering* had a most interesting cover (see cut) and news story on urea. It naturally stressed the Pechiney process, soon to be used commercially for the first time in America. . . .

Your readers may also be interested to know that the Inventa process, used commercially in Switzerland since 1939, is now attracting considerable interest in the United States.

The Inventa process was developed by Inventa's affiliated company, Holzverzuckerungs A. G. (Hovag) of Ems, Switzerland. It can be operated with a complete recycle of unreacted carbamate or as a straight once-through process. Corrosion problems have been practically eliminated. . . .

PIERRE J. BONET

Engineer

Zurich, Switzerland

► Reader Bonet is correct. Just last month Vulcan Engineering division of Vulcan Copper & Supply Co. announced that it had acquired exclusive American and Canadian rights for building plants to produce synthetic urea by the Inventa process. Vulcan has already translated the Swiss process to American design requirements.—Ed.

Statistics: Figure or Range?

Sir:

Dr. Ferencz' article "Statistics Can Put More Meaning in Your Cost Estimates" in the April (p. 143) issue was very much worthwhile in its pres-

entation of a new way to apply statistical concepts to practical engineering. However, potential users should be fully aware of the assumptions in the procedure and the limitations that result.

In particular, there is the estimation of a range to cover 99 percent of the probable costs. It is true that this range divided by 5.2 gives the standard deviation when the range has a 99 percent coverage; but who is going to say whether that range covers only 95 percent of the values or 99.99 percent? For 95 percent coverage the divisor is 4.0, for 99.99 percent coverage it is 8.0.

Thus, if the estimated ranges in Dr. Ferencz' Table I covered only 95 percent of the possibilities instead of 99 percent, the standard deviation of the profit would be \$104,000 (1.83 percent) instead of \$79,810; with 99.99 percent coverage it would be \$51,900 (0.94 percent) instead of \$79,810. These different values might easily change the analysis of the profit picture.

With this procedure, then, the estimator's problem has been transferred from predicting an accurate single figure to predicting an accurate range. On the other hand, the latter problem may be the easier to solve. Evaluation of the method can best be done with actual estimates and see how they turn out when the projects are completed.

W. R. LUDKA

Chemical Engineering Dept.
Minnesota Mining & Mfg. Co.
St. Paul, Minn.

► See the letter that follows for Dr. Ferencz' answer to Reader Ludka's interesting point.—Ed.

Statistics: Estimate a Range

Sir:

Mr. Ludka raises the question whether and to what extent it is justified to take the standard deviation as equal to $1/5.2$ of the estimated range. I considered that point in a previous article, published in "Chemical & Engineering News," Oct. 8, 1951, but for reasons of brevity omitted the explanation in *Chemical Engineering*.

When our estimate is based on ob-

served values—such as results of tests—then the mean value and the standard deviation can be calculated by usual methods.

When actual values cannot be observed (as in sales forecasts, probable power consumption, labor requirements) then we estimate a range within which actual values are expected to occur. By doing so we have to assume a certain distribution of the probabilities for smaller intervals inside the range.

That distribution must be a reasonable one. For instance, when we estimate our future sales in the range of 9,000 to 10,000 tons per year then it would not be reasonable to assume the same probability for all intervals 9,000-9,100, 9,100-9,200 and so on up to 9,900-10,000 and no probability at all for the intervals 8,900-9,000 and 10,000-10,100 and beyond those.

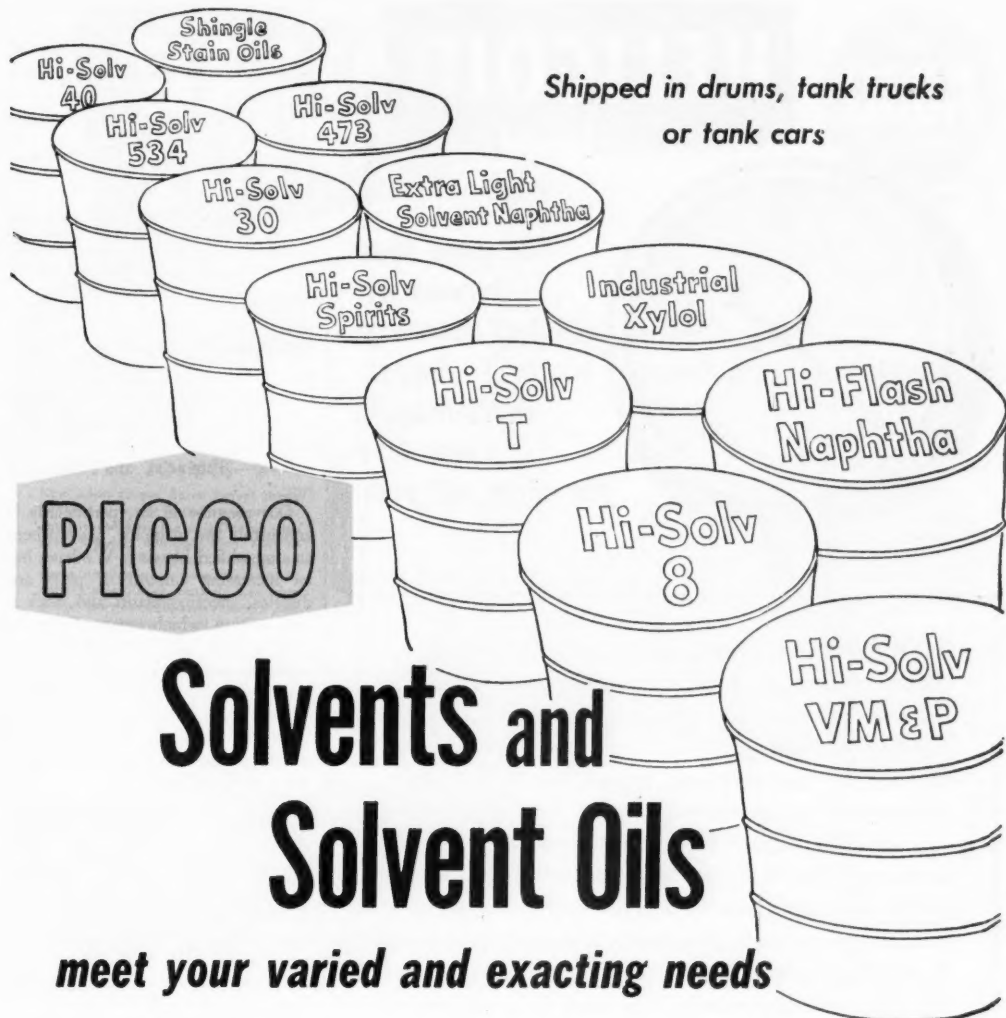
Similarly, it would be unreasonable to assume a distribution like: 0.1 percent probability for 9,000-9,200, 15 percent for 9,200-9,400, 70 percent for 9,400-9,600, 13 percent for 9,600-9,800 and 1.9 percent for 9,800-10,000. In that case we would probably draw narrower limits for the range.

However, a reasonable distribution would be: 5 percent for the intervals 9,000-9,200 and 9,800-10,000 each, 25 percent for the intervals 9,200-9,400 and 9,600-9,800 and 40 percent probability for the middle interval.

We may assume some other reasonable distributions as well, even also asymmetric ones. For every assumed distribution we can calculate the standard deviation by the formula for grouped data. The resulting standard deviations—I carried out that test for a great number of such distributions—were always between $\frac{1}{4}$ and $\frac{1}{6}$ of the range, mostly rather close to $\frac{1}{5.2}$.

I believe that coincidence can be readily explained by realizing that when we estimate a range we won't include intervals with only 1-2 percent probability; mostly we have to deal with probabilities which are approximately normally distributed.

I fully agree with Mr. Ludka's last remark that the calculations should be checked with the actual results. Especially, individual items of estimations, such as power, labor, yields, etc., can



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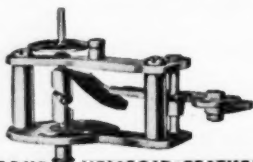
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Pressure
•
Vacuum
GAGES**

READERS' VIEWS, cont. . .

be readily checked. The observed values will then enable the estimator to improve his later estimates.

P. FERENCZ

Chemical Engineer
Canadian Industries, Ltd.
Montreal, Canada

► The many readers who have shown an interest in Dr. Ferencz' April article will be glad to learn that he is now preparing a special report on applied statistics for the chemical engineer.—Ed.

Ecological Approach

Sir:

Let me congratulate you upon the excellent article by Vannevar Bush in your June issue of *Chemical Engineering*—"Engineers and Their Future."

Our progress so far, particularly in agriculture and medicine, has not been an unqualified blessing. We have had an increasing amount of pests and diseases, affecting plants and stock as well as man, which apparently spring from a weakening of some inner resistance, not easily diagnosed. No amount of better and more pesticides, as Mr. Bush states as necessary, will solve the problem. Figures can be quoted to show that pests have multiplied with the pesticides.

The right approach to our problems today is the ecological approach. The development of this understanding, now making steady progress, is the most significant in recent years.

This brings us to the soil conditioners about which Mr. Bush is so enthusiastic. He says himself that these conditioners are not digested by bacteria in the soil.

But some bacteria, like saprophytes, live upon organic matter and are necessary to control pathogens. If saprophytic bacteria are deprived of their food by chemicals which will do the other jobs of organic matter in the soil, where will that leave the pathogens?

The ecological approach requires that such new soil conditioners be first tested for their effect upon disease resistance, reproductive ability, and general stamina of the crops grown in soils so treated. Where are such tests considered important today? I have not been able to locate one experiment station working on this.

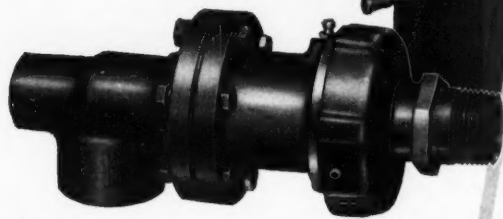
H. E. LOBSTEIN

Bloomington, N. Y.



① SWIVEL JOINTS

New lower torque Barco Swivel Joints enable you to put flexibility where you want it—without the nuisance of sagging, flopping, non-rigid lines. Easy to position lines for good drainage on steam applications—no water pockets, better temperature control! Exclusive design provides 360° swivel action plus side flexibility to prevent binding. No leakage under varying conditions of vacuum or pressure, heat or cold. Ask for engineering recommendations and latest literature.



② REVOLVING JOINTS

Here is Barco's new, improved Type 1BR Revolving Joint for supplying steam, water, oil, or other fluids to rolls, dryers, drums. Inherent low torque is little affected by pressure, speed or temperature—thanks to special ball bearings used in combination with self-lubricating graphite-carbon bearing. Internal parts are readily accessible—usually without removing joint. Single flow or syphon styles. Ask for Bulletin 300.

for BANBURY MIXERS

produced by
FARREL-BIRMINGHAM

Photo: Size B
Banbury Mixer.



Among fabricators of rubber, plastics, linoleum, asphalt products, and other heavy compounds, Banbury Mixers are recognized as one of the most efficient types of production equipment ever developed. Designed and manufactured by Farrel-Birmingham Company, Inc., Ansonia, Conn., Banbury Mixers embody many advanced engineering features. Here, as elsewhere, you will find BARCO: (1) Barco Swivel Joints to provide flexibility in piping and (2) Barco Syphon connections for steam or cooling water piping to mixer rotors.

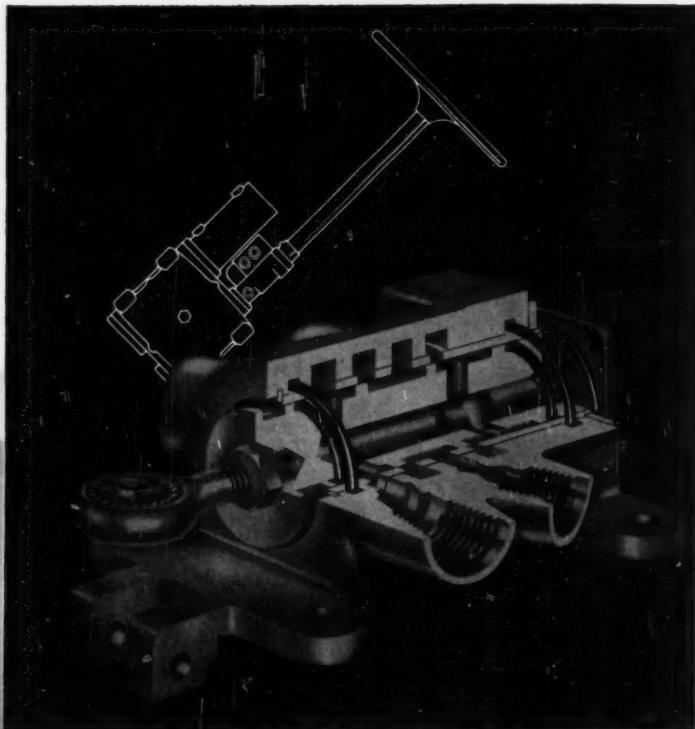
If you have a design or operating problem that calls for flexibility, movement, or rotation in piping connection, BARCO HAS THE ANSWER!

BARCO Manufacturing Co.

1816L Winnemac Ave., Chicago 40, Ill. • In Canada: The Holden Co., Ltd.

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

CHEMICAL ENGINEERING—October 1952



Cutaway view showing PARKER O-rings in control valve of Ross Hydropower Steering Gear.

PARKER O-RINGS... for Simplified Sealing

THIS IS IT



Cross section drawing of O-ring in groove, sealing under pressure.

It's easy to design your product to incorporate PARKER synthetic rubber, *leakproof* O-ring seals. That's why they're economical to use. A simple, small groove is all that's required. There is no structure to support; no added weight. They can be used in either moving or non-moving applications... are easy and economical to replace.

PARKER is the one source for *all* standard O-rings to meet specifications covering fuel, hydraulic and engine oil services... and for special service O-rings of tested and approved compounds. Ask your PARKER O-ring Distributor (see right) for Catalog 5100, or write The PARKER Application Co., 17325 Euclid Ave., Cleveland 12, Ohio.

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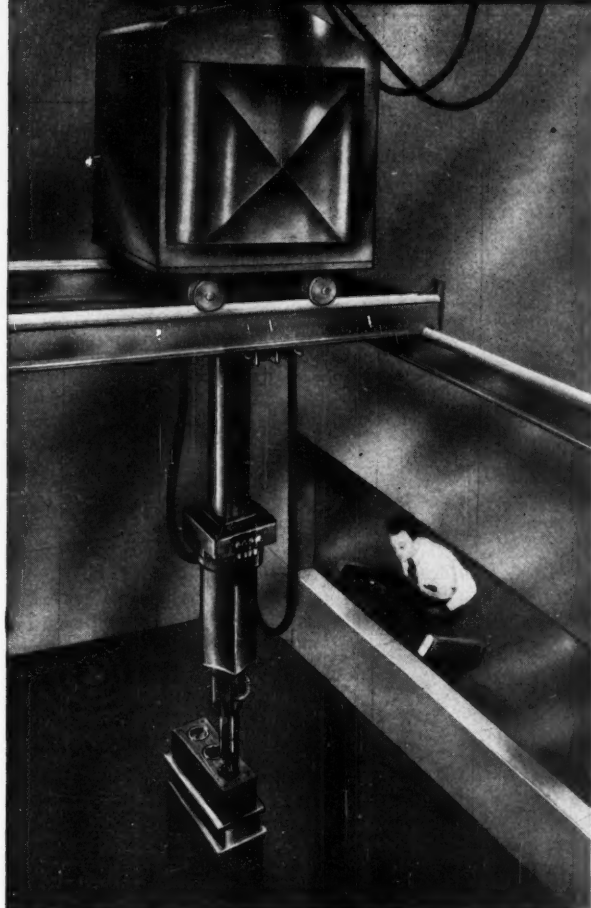
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THE GREER REMOTE-CONTROL MANIPULATOR



Rivaling the versatility of a human hand, Greer's new manipulator permits a man to handle dangerous materials by pushing buttons!

The assignment wasn't easy. Greer engineers knew the complex mechanics involved in human hands. The simple act of picking up a pencil, for example, may encompass half-a-dozen distinct and separate motions. But today — after years of patient research and development — Greer is proud to present the proved solution — the Greer Bridge Hydraulic Manipulator.

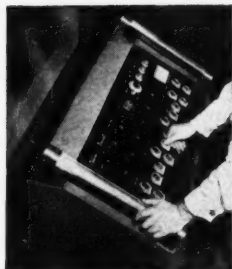
Providing the operator with complete protection and unimpeded view, this manipulator is ideal for such applications as handling radioactive and highly toxic materials, dangerous chemicals, and others.

It is a product of Greer Research & Development, a division accustomed to dealing with such out-of-ordinary problems. This department maintains a staff of expert engineers at your disposal; please feel free to call on us at any time. There is no cost or obligation.

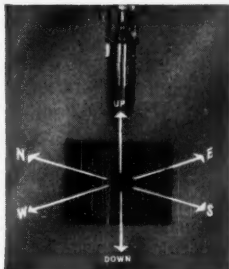


Operator, in photo on left, automatically engages 2½" finger-action tool capable of exerting up to 1500 lbs. Vise and socket tools are shown in tool holder.

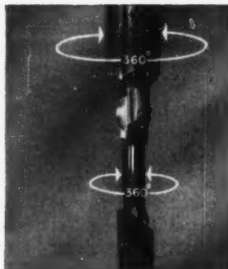
A MASTER CONTROL BOARD PINPOINTS OBJECTS, CONTROLS 7 SEPARATE MOTIONS



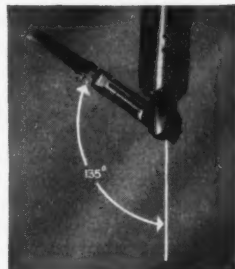
Push buttons control all motions. Rates of motion are determined by foot or hand control. Mobile control panel is mounted on "V" rail and keeps operator opposite work.



Positioning motions are (a) longitudinal, (b) transverse, and (c) vertical. These motions are provided by (a) mobile bridge, (b) trolley, and (c) hydraulic ram.

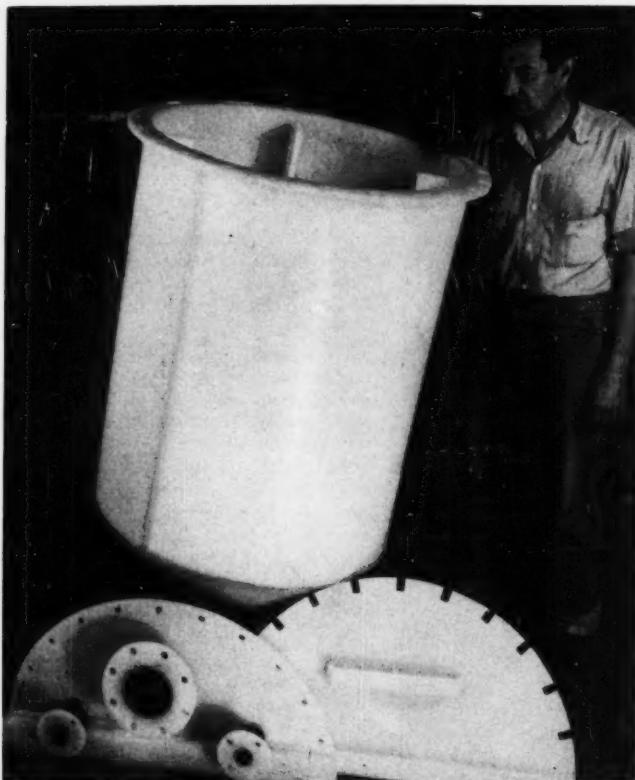


Rotation of both upper arm and wrist is accomplished through a system of gears and worm gear drive. System is adjusted to prevent interaction between motions.



Elbow action is provided by a 23" forearm rotating in a vertical plane through a 135° arc. This motion can produce 2100 inch-lbs. of torque with 100 lbs. load.

GREER HYDRAULICS INC. • 454 EIGHTEENTH STREET • BROOKLYN 15, NEW YORK



Welded 40-gal. polyethylene separator constructed from cast tubing and sheet.

Polyethylene

The corrosion resistance of this thermoplastic material of construction to a number of corrosives, with its physical properties, forms available and applications.

J. L. HUSCHER

American Aglle Corp., Bedford, Ohio

Within a relatively short period, polyethylene has reached a leading position among industrially used plastic materials. Total world production can be expected to reach about 140,000 tons annually within two to three years.

During the war, use of polyethylene was reserved for military purposes. It played a major role in the development of radar equipment.

When released for civilian use after the war, engineers were quick to recognize its many outstanding physical and chemical properties. Polyethylene has reached considerable proportions during the course of a very few years as a material of construction for the chemical process industries. It has replaced lead, tin, copper, and stainless steel among other materials in some applications.

CHEMICAL AND PHYSICAL PROPERTIES

Chemical composition of polyethylene is rather simple, as it consists of a long essentially-saturated hydrocarbon chain.

Standard grades of polyethylene now available in the U. S. have a molecular weight from 18,000 to 21,000. It is a greyish translucent thermoplastic material, which, as may be expected from its chemical composition, is inert to most gases and chemicals at temperatures up to 165 deg. F. It is totally unaffected by water and has outstanding electrical properties. At room temperature, polyethylene has a 60-75 percent orthorhombic crystalline structure, the balance being amorphous. Upon heating above 150 deg. F., transformation of the crystalline structure into the amorphous phase begins. This transformation is about completed when the melting point (239 deg. F.) is reached. It has the lowest specific gravity of any commercial plastic and is insoluble in solvents at temperatures below 155 deg. F.—but soluble in some solvents at higher temperatures.

Table I is a summary of the most important physical properties of polyethylene.

Polyethylene remains flexible over a wide temperature range without addition of any plasticizers. As a matter of fact, it is incompatible with most other thermoplastics and plasticizers, except for certain synthetic rubbers, polyisobutylene, and paraffins. The mixture of polyethylene and polyisobutylene is of particular interest, since it results in a material of greater flexibility, particularly at sub-zero temperatures.

FABRICATING METHODS

Hand in hand with the recognition of polyethylene as outstanding material for the chemical and allied industries grew the need for larger and more complicated shapes. The usual fabricating methods such as injection and compression molding, extruding, and even casting were not suitable or economical. Therefore new methods had to be developed.

Most common method for joining plastic materials, i.e. cementing, cannot be satisfactorily used with heavier

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SERIES 310A
"KARBATE"
BRAND
Standard
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point to "Eveready" No. 1050 Industrial Flashlight Batteries... delivering twice as much usable light as any battery we've ever made before. Their unique construction prevents swelling or jamming in the case... has no metal can to leak or corrode.



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FEATUREING lower cost per unit area of heat transfer surface, National Carbon's new Series 310A "Karbate" Shell-and-Tube Heat Exchanger replaces the well known Series 240A Exchanger. Retaining all the time-proved advantages of its predecessor, this exchanger also provides new design improvements... products of many years' experience in the application of impervious graphite to heat transfer equipment.

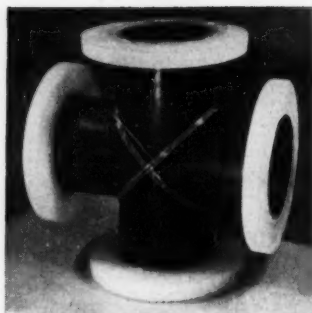
Another new model, Series 90A, replaces the previous Series 70A to provide increased capacity and several new and improved features of construction.

NO OTHER DESIGN OFFERS ALL THESE ADVANTAGES

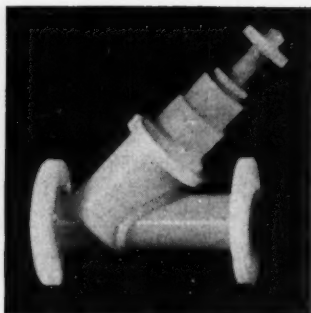
- Lower cost per unit area
- Interchangeable single- and multi-pass construction
- Low tube and shell side pressure drop
- Easy tube replacement
- Factory stock for quick shipment
- Separate and removable "Karbate" impervious graphite fixed and floating end covers
- Rugged Type SN cover connections
- Oversize shell connections—built-in vapor belt and impingement plates
- Removable "Karbate" impervious graphite tube bundle with stainless steel baffles
- Asbestos composition, "Neoprene", or "Teflon" gaskets

NO OTHER MATERIAL COMBINES ALL THESE PROPERTIES

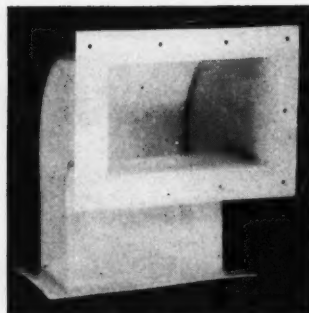
- Chemical resistance to practically all corrosive fluids
- High rates of heat transfer (three times that of carbon steel)
- Immunity to thermal shock
- Low maintenance



Welded and flanged polyethylene cross.



Polyethylene valve.



Polyethylene duct line, 10 by 18 in.

sections of polyethylene. This is due to its inertness to most chemicals used as adhesives. Thin films of polyethylene have been cemented chemically with a certain degree of success. Absence of a suitable cementing technique for heavier sections is the chief reason for use of the hot gas welding method for fabricating polyethylene shapes.

Principle of the hot gas welding process for thermoplastic materials is similar to that of the oxy-acetylene welding of metals. The open gas flame furnishing the welding heat in the latter process is substituted by a stream of heated inert gas (nitrogen, air, carbon dioxide, etc.). Filler rod employed in the plastic welding process is usually of identical composition as the parent material. In view of the sharply defined melting point, polyethylene lends itself excellently to this simple yet extremely versatile and reliable joining method.

Filler rod is laid down into the welding joint while the hot gas stream is applied to the space between the filler rod and the parent material. This permits the deposition of multi-layer welds for heavier structures. Contrary to the welding of metals, the penetration of the filler rod into the base material is very limited, yet a strength of welding seams up to 90 percent that of the base material has been achieved. Polyethylene can also be easily drilled, sawed, and machined on wood and metal working machinery.

Unusual properties of polyethylene (such as its large coefficient of expansion) must be taken into account before considering its use. It is advisable to have its fabrications carried out by specialists who are familiar with all the peculiarities of material and design.

Polyethylene installations can be

used up to 150 deg. F. and frequently up to 175 deg. F. The fabricator should be completely informed about the intended use of the equipment—i.e. type of corrosive exposure, concentration, temperature, etc.—to adapt the design to the particular end use and to safeguard proper functioning.

VESSELS

For certain containers, storage tanks, and reaction vessels polyethylene can be employed in the form of self-supporting fabrications, comprised of sheets, plates, extruded and cast tubing.

Polyethylene containers are in use for handling and shipping corrosive

chemicals, particularly hydrofluoric acid. These containers are fabricated from molded, extruded, and cast sections. They offer complete rigidity in addition to outstanding corrosion resistance, impact resistance, and light weight. Such containers weigh about $\frac{1}{4}$ of their equivalent in glass and $\frac{1}{13}$ of that in lead. The economic importance of these containers is evident in view of increasing shipping costs.

In keeping with the tensile properties of polyethylene, supported structures are recommended where considerable internal pressure exists—such as in constantly-filled tanks—or where mechanical abuse is predominant.

(Continued on page 276)

Table I—Physical Properties of Polyethylene

Mechanical Properties (at 70° F.)

Property	Unit	Average Test Result	Method
Ultimate tensile str.	Lb./in. ²	1,500-2,000	ASTM D638-49T
Yield point	Lb./in. ²	1,200-1,300	ASTM D638-49T
Elongation	%	400-500	ASTM D638-49T
Impact str., Isod.	Ft.-lb./in.	16	ASTM D256-47T
Stiffness	Lb./in. ³	16,000-19,000	ASTM D747-48T
Modulus of elasticity	Lb./in. ²	17,000-19,000	ASTM D638-49T
Tear resistance	Lb./in. thickness	570	ASTM D824-48T
Shear strength (0.125" thickness)	Lb./in. ²	1,500	Johnson Shear Jig
Compressive strength at 1% deformation	Lb./in. ²	280	ASTM D695-44T
Hardness	Rockwell, R-scale	11	ASTM D785-48T
Thermal Properties			
Thermal conductivity	Btu./hr./ft. ² /°F./in.	2.15	Cenco-Fitch App.
Coefficient of linear expansion	°F.	9×10^{-4}	ASTM D696-42T
Specific heat	Cal./gm./°C.	0.55	ASTM D560-43T
Flow temperature	°C.	106	
Melting point	°C.	110-120	
Deformation under load	2000 Lb./in. ²	0.6	ASTM D621-B-44T
Electrical Properties			
Dielectric Strength (Short time, 0.125" sheet)	V./Mil	460	ASTM D149-44T
Volume resistivity	Ohm-cm.	10^{12}	ASTM D257-46T
Dielectric constant (60 to 10 ⁶ cycles)		2.3	ASTM D156-47T
Power factor (60 to 10 ⁶ cycles)		0.0005	ASTM D150-47T

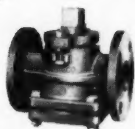
Table II—Standard Sizes of Extruded Polyethylene Pipe

Nom. Pipe Size, In.	O.D., In.	I.D., In.	Est'd. Burst Pressure, Psi.	Weight Per Ft., Lb.	Standard Shipping Length, Ft.
$\frac{1}{2}$	0.840	0.622	540	0.103	400-coil
$\frac{3}{4}$	1.050	0.824	350	0.140	400-coil
1	1.310	1.070	200	0.181	300-coil
1 $\frac{1}{4}$	1.660	1.380	200	0.267	300-coil
1 $\frac{1}{2}$	1.900	1.610	200	0.320	250-coil
2	2.378	2.070	170	0.445	200-coil
2 $\frac{1}{2}$	2.875	2.460	170	0.680	200-coil
3	3.504	3.070	165	0.910	100-coil
4	4.504	4.030	150	1.250	25-str.
6	6.630	6.070	115	2.230	25-str.

Write

for reasons why DURCO equipment—in DURCO alloys—works better, lasts longer, solves your corrosion problems

These DURCO products are representative of the DURCO family of engineered equipment. All are designed to operate at peak efficiency and are manufactured in special DURCO alloys to withstand severe corrosion!



Durco F Valve. Non-sticking, non-lubricated. Teflon sleeve eliminates metal-to-metal contact. Highly satisfactory in toughest chemical service. Sizes: 1/4" through 2".



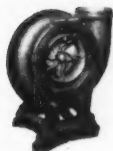
Series R Durcopump. A heavy duty centrifugal pump for severe corrosive service. Available with interchangeable wet end parts in special Durco alloys for most corrosive conditions.



Duriron Acidproof Pipe. Highly resistant to almost all commercial acids at practically all concentrations and temperatures. Installed by usual plumbing methods as permanent lines.



Durco Heat Exchangers. Simple and efficient units for heating or cooling corrosive liquids. Designed for flexibility in mounting. Available in several DURCO alloys.



DURCO Exhaust Fans can be obtained in sizes, drives and capacities to meet most requirements. Available in Duriron and Durichlor.

THE
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General Catalog 53

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October 1952—CHEMICAL ENGINEERING



*Trade-Mark

Offers an
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The solvents and chemicals sold under the ENJAY* Oval Trade-Mark are outstanding for high quality and dependability. Every day more industries are calling on the long experience of the Enjay Company . . . making greater use of the diversified line of solvents and chemicals marketed by Enjay to increase product quality.

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**ENJAY markets this wide range
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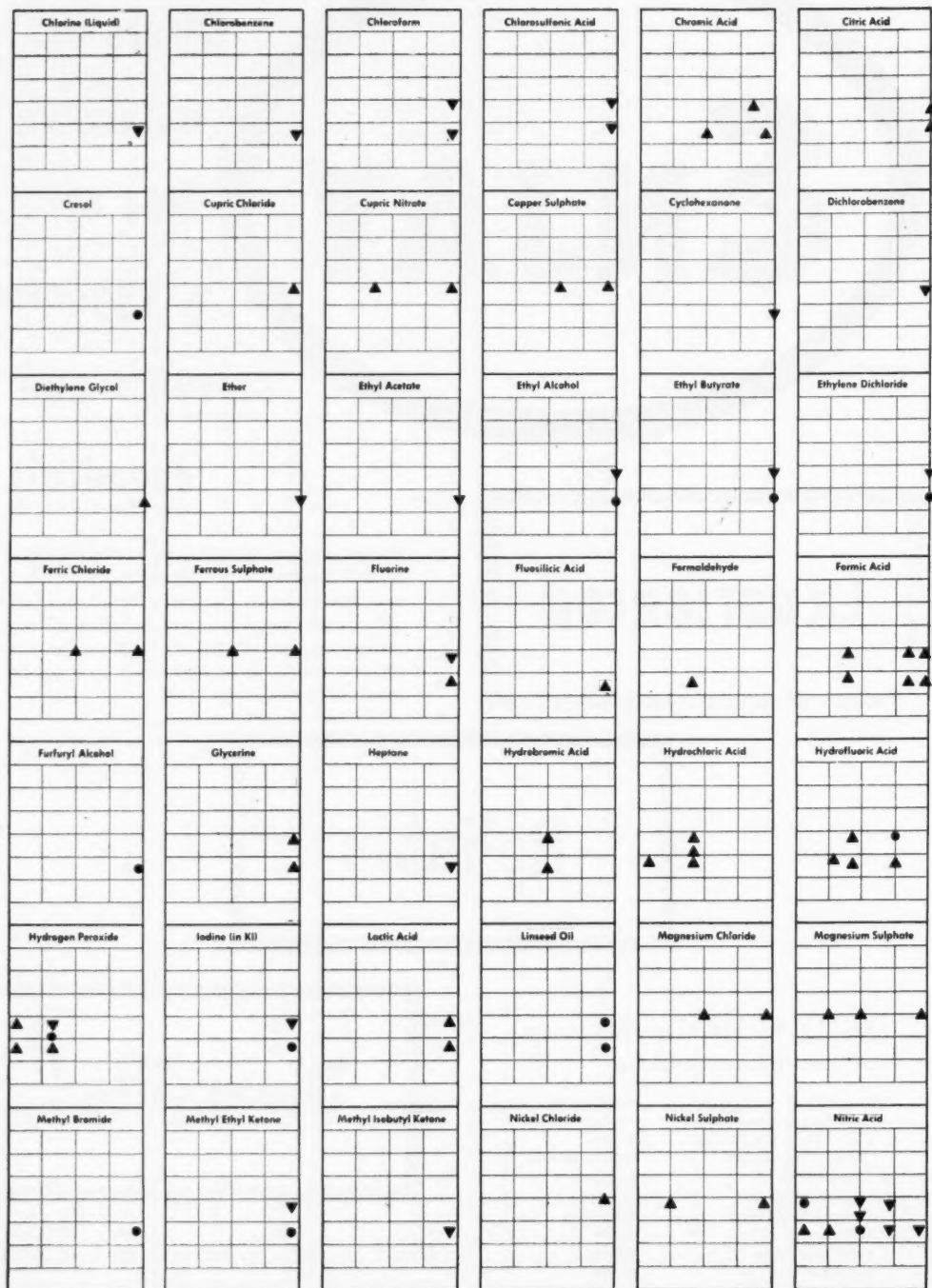
Petrohol 91 (Isopropyl Alcohol)
Petrohol 93 (Isopropyl Alcohol)
Petrohol 99 (Isopropyl Alcohol)
Secondary Butyl Alcohol
Isooctyl Alcohol
Isopropyl Acetate
Secondary Butyl Acetate
Acetone
Methyl Ethyl Ketone
Ethyl Ether
Isopropyl Ether
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Diversified

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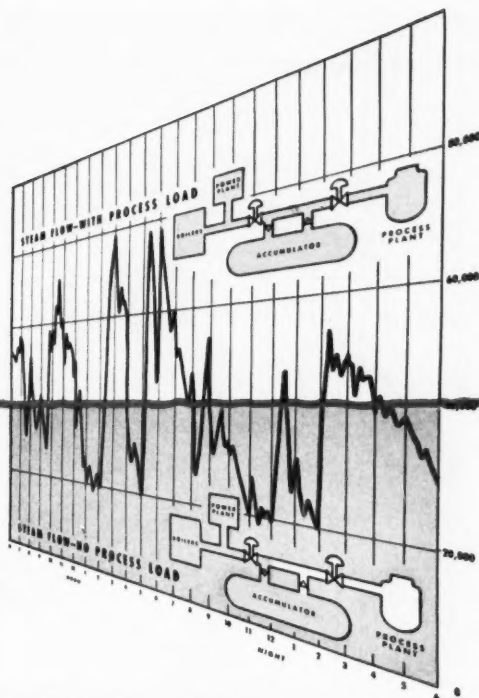
ENJAY COMPANY, INC., 15 West 51st St., New York 19, N. Y.



(Continued on page 268)

balancing
steam supply
and
demand

economically—
automatically—
with the
**FOSTER WHEELER
ACCUMULATOR**



Now you can operate your boilers at their most economical level, and automatically supply constant-rate, high-pressure steam to your power plant *plus* steam for the severe fluctuating needs of your process departments.

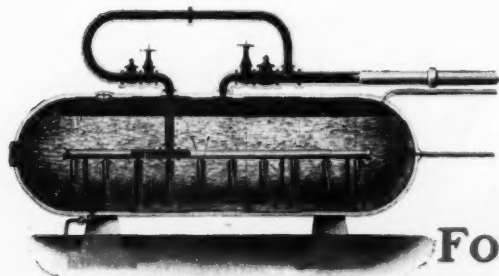
The Foster Wheeler Steam Accumulator automatically takes the "swings" of intermittent high-steam demand by storing the heat energy of steam in a large quantity of water under pressure, and at saturation temperature, and releasing the energy in the form of steam at a lower pressure. Thus, with the boiler plant operating at its most economical constant rate, the accumulator will receive, condense and store steam during periods of low process-plant demand and return it to the steam lines during periods of high demand in the processing departments.

REDUCES REQUIRED BOILER CAPACITY

In plants without an accumulator, boiler capacity to meet peak process loads may need to be double the average load. However, where an accumulator is installed, boiler capacity need only be sufficient to meet the average load. Thus a reduction is made possible in the size or number of boilers required.


INCREASES BOILER EFFICIENCY

The constant load at which the boilers operate in conjunction with an accumulator, plus the ability of the accumulator to supply all peak demands, assures constant steam pressure, maximum efficiency and capacity in both power generation and process work.



Each Foster Wheeler Accumulator is designed to meet the particular requirements in your plant. Installations have been made as small as 200 cu. ft. and as large as 176,000 cu. ft. Send us the details of your problem today. Write to:

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This is the eleventh in a series of chart data presentations.

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Polyesters, Dec. 1952

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Sulphur Cements, Feb. 1952

Silicate Cements, March 1952

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Hastelloy C, June 1952

Hastelloy B, July 1952

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Carbon & Graphite, Sept. 1955



from
SMALLEST
 for shipyard
 operation
 to
LARGEST
 for industrial
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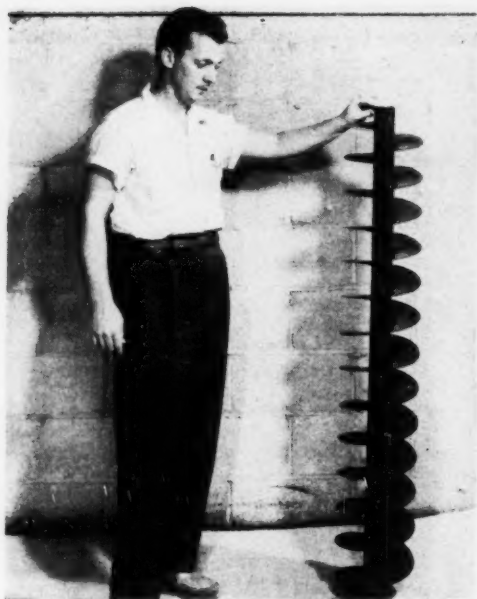
ACME IMPREGNATORS ARE MORE EFFICIENT!

The small impregnator illustrated above at the left measures only 36" in diameter. It is one of a battery of four especially designed and precision-built by Acme to meet specific conditions for a dock installation.

The large Horizontal Jacketed Impregnator, measuring 11'-4" in diameter and 17'-6" in length, has a volume of 11,000 gallons. It operates at 150 p.s.i. working pressure and full vacuum at a temperature of 650°F. An efficient hydraulic mechanism provides smooth operation of the 5-ton door.

Whether your processing problem is a midget or a giant in size—whether it encompasses engineering and design or fabrication alone—at Acme you will find the skill, the equipment and experience to insure the most economical solution.





SLICK ceramic coating on screw at left moves wet gypsum without jamming conveyor.



LARGE ceramic coated cones for use where high temperature, corrosion and thermal shock are problems.

New Look at Ceramic Coatings

Advent of new high-temperature ceramic coatings justifies a reappraisal of the field for use in conjunction with chemical processing equipment.

W. A. BARROWS, Barrows Porcelain Enamel Co., Cincinnati, Ohio

Recent research, prompted in a large part by the jet-engine program, has resulted in a completely new group of porcelain enamel coatings. These coatings deserve new attention from chemical engineers, because of their unusually high heat resistance and their corrosion resistance.

Porcelain enamel and ceramic coatings are being used today as coatings for chemical processing vessels, acid storage tanks, brine tanks, chemical piping, and smoke stacks. Present day use of these coatings is only a small part of the potential chemical applications.

HEAT AND CORROSION RESISTANCE

Basically, the new high-temperature ceramic coatings are, as the name implies, coatings designed to withstand substantially higher temperatures than ordinary porcelain enamels. Whereas

ordinary porcelain enamels are limited to sustained use at temperatures of less than 1,000 deg. F., the high-temperature ceramic coatings generally can be used at temperatures of 1,600 to 1,800 deg. F. for long periods of time, corrosion and mechanical factors normal.

Normal weather does not cause corrosion of metal parts coated with these ceramic coatings. The coatings completely cover the metal parts.

Acids and alkalis present a particular corrosion problem which requires additional consideration. It can be stated generally that there are two groups of porcelain enamels and ceramic coatings: (1) those which are suitable for use only under normal atmospheric conditions and can thus be used with solutions that are normally free from acids and alkalis, and (2) those which are resistant to most acids except hydrofluoric acid.

As an example of ceramic resistance characteristics, Solaramic—a special ceramic coating—will withstand reducing and oxidizing atmospheres and is reasonably resistant to chlorine, sulphur dioxide or trioxide, carbon dioxide, and vanadium gases. Samples of Solaramic 52-10 on acid and alkali tests showed 0.0005 grams per sq. in. loss in 6 percent citric acid solution at boiling temperature for 24 hr. Loss of 0.0007 gm. per sq. in. in 5 percent sodium pyrophosphate solution at boiling temperature for 24 hr. was experienced.

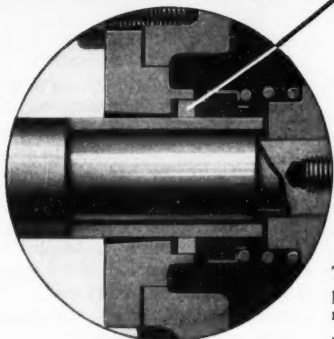
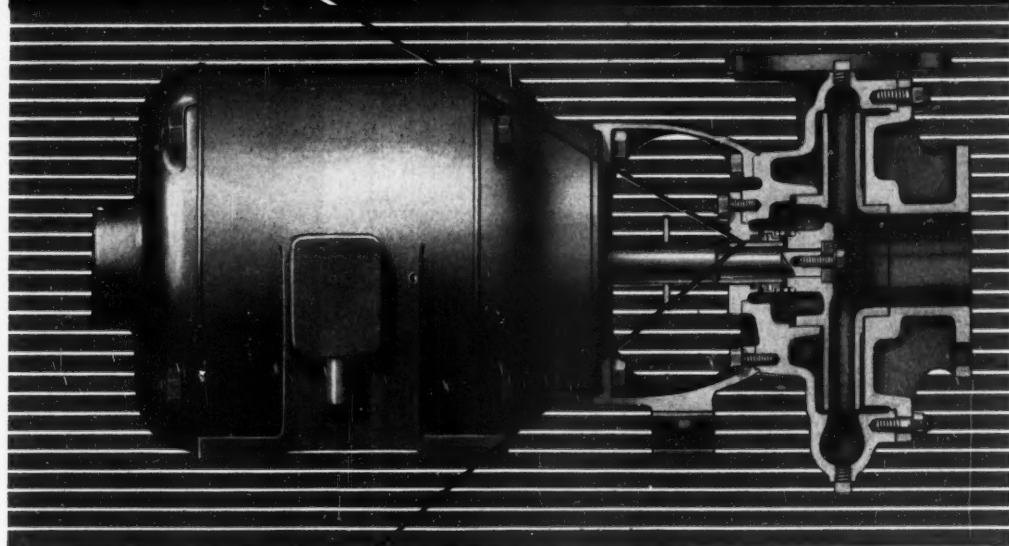
The problem of alkali resistance of porcelain enamels is somewhat similar to that of acid resistance. It can be stated generally that ceramic coatings are resistant to mild alkalis and detergent solutions.

BASE METAL FACTORS

It is important that chemical engineers be familiar with certain other factors, particularly those concerned with the characteristics of the metal to which the ceramic coating is to be applied.

For example, porcelain enamel can be most easily applied to enameling iron and cast iron. Cold-rolled steel provides the next best base. The new

NEW *Remite* SEAL ENDS LEAKAGE TROUBLES



Cross-section showing Remite Mechanical Seal.

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The "REMITE" Mechanical Seal of this pump presents a revolutionary new development in pump design . . . eliminates leakage . . . assures long, trouble-free life.

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B & G Series 1531 Uni-built Pumps are made with capacities to 1200 GPM, heads to 400 feet.

Send today for catalog No. ET-452, giving complete engineering data on the B & G Series 1531 Uni-built Centrifugal Pump.



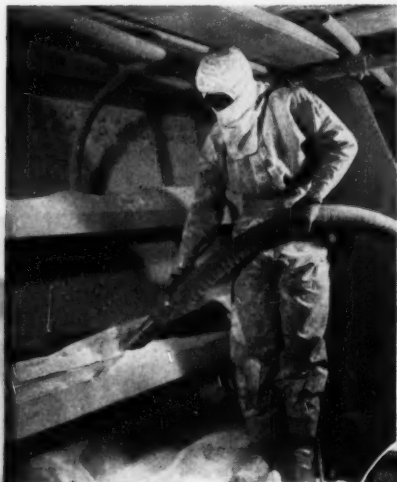
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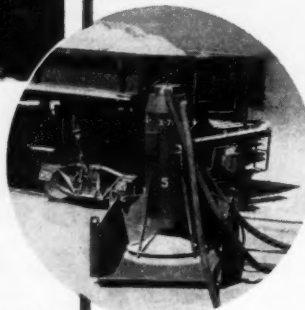
Vacu-Veyor uses a vacuum pickup nozzle and a flexible 3-inch hose to carry material to the unloader. If desired, a pressure hose can be used for discharge. The Vacu-Veyor can convey material as far as 100 to 200 feet horizontally and as high as 65 to 100 feet above its source.

TYPICAL LABOR SAVING APPLICATIONS

Removal of sand from sand blasted ship fuel tanks is one of the widely successful applications of the Vacu-Veyor. In a typical case, it used to be necessary to have 8 to 20 men shovel thousands of pounds of sand and remove it by "bucket brigade." Now, two men with a Vacu-Veyor remove this sand at a saving in labor cost sufficient to pay for the machine in a month.

Another practical application of the Vacu-Veyor is the moving of sand and other material from trucks into high feed hoppers.

Vacu-Veyor moves into rough, tight spots to unload sand, grain, chemicals or any granular material. It provides pneumatic transport of material where only buckets and shovels could otherwise be used. In unloading tanks, bins, trucks, railroad cars and ships, one man can move up to 25,000 pounds of material per hour.



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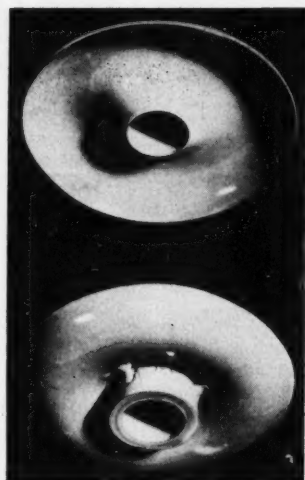
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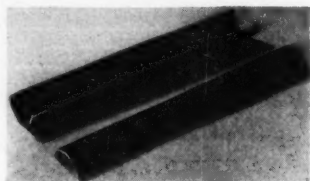
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CORROSION FORUM, cont. . .



Porcelain enamel-coated cup for radiant burner replaces solid ceramic cup.



Porcelain enamel coated pipe cut to show exterior and interior coating.

high-temperature ceramic coatings, on the other hand, can be applied to any of the commonly available stainless steels, including straight chrome stainless. However, one of the new high-temperature coatings is designed for use on the 1010 steels and will greatly improve the heat resistance of cold-rolled steel. Generally, non-ferrous metals do not form a good base for the application of porcelain enamel or ceramic coatings.

Porcelain enamel and ceramic coatings both can be applied according to strict tolerances. If necessary, tolerances of a few thousandths of an inch can be held. Ordinary coatings run from 0.005 to 0.03 in. High-temperature coatings are generally applied at a thickness of 0.001 to 0.0015 in.

Mechanical impact which various porcelain enamel and ceramic coatings can withstand is extremely high, and it can be stated as a rule of thumb that the coatings will adhere to a metal up to the yield point of the metal.

Coefficient of expansion of brazing materials and the low melting point

of solder makes them impractical for coating with ceramic coatings. Pieces of non-uniform thickness result in non-uniform penetration during fusing of the glass.

RAW MATERIALS

Raw materials (metal oxides and fluxing agents) for ceramic coatings are widely available. Therefore, cost and supply problems, which confront chemical engineers more and more during these days of scarce and expensive metals and alloys, are considerably lessened when these coatings are used. Almost any ceramic coating can be supplied readily at a relatively low cost. Certain frits (frits are the raw material mixture from which the coatings are prepared), costing as high as \$2/lb. are the exception. Most frits cost about 10 c./lb. However, even the expensive mixtures have more than justified their use, because coatings of these frits are applied in thin films and have increased tremendously the life of parts on which they have been used. At the same time, they have reduced maintenance costs. Coatings prepared from the lower cost frits have proven to be good materials because of their good competitive price position and other desirable characteristics when compared with results obtained.

Copper-Clad Steel In Commercial Production

Commercial production of copper-clad steel plate, a new engineering material combining the special properties of copper and steel, has been announced by Lukens Steel Co. Copper-clad steels are expected to meet a long-felt want for many electrical, heat transfer and corrosion applications requiring copper's high conductivity and corrosion resistance combined with steel's low cost, strength and rigidity. Applications will include electrical apparatus, evaporators, hot water heaters, heat exchangers, tube sheets, tanks and vessels.

Combining unique chemical and physical characteristics with good fabrication properties, copper-clad steels simplify problems of equipment and fabrication in many types of applications. Fabrication time can be cut considerably, cutting production costs. For many types of equipment a smaller thickness of copper-clad steel can serve the same purpose as a thicker section of solid copper, reducing material costs and saving space and weight.

Available in plate gages only, Lukens

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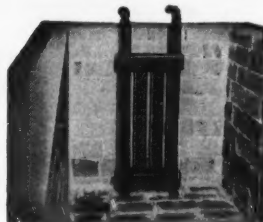
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densate at 160° and others discharging it at about steam temperature, they feel heat loss was cut nearly in half. Due to their effectiveness in controlling temperature as well as draining condensate, Nicholson traps are paying for themselves in many industries.



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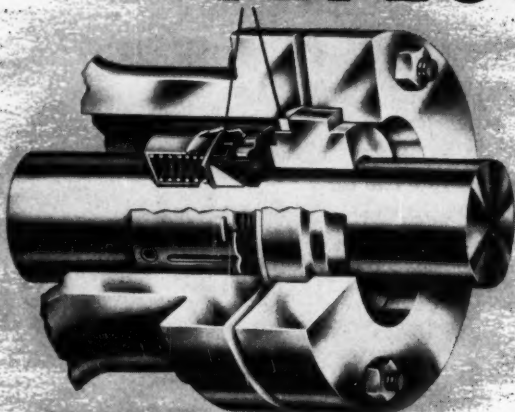
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This revolutionary seal was developed by Crane Packing Company after two years research and field testing—expressly for use with hard-to-handle chemicals. Its flexible wedge ring and sealing ring are molded from the remarkable new plastic, Teflon, which is not affected under any known corrosive or solvent service.

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CORROSION FORUM, cont. . .

copper-clad steel consists of a layer of copper permanently and uniformly bonded to one side of a carbon steel backing plate. Cladding percentages of 10, 15 or 20 percent of total plate thickness will be regularly furnished in plate sizes up to 120 in. width, 380 in. long and $\frac{1}{8}$ to 14 in. thick. Copper-clad steels are also available in flanged only or flanged and dished heads.

Homogeneous and dense in structure, the copper is unchanged in any way by being bonded to the steel. Characteristic special corrosion resistance and excellent electrical conductivity are assured. Two types of cladding are regularly furnished; oxygen-free high conductivity copper for special electrical applications, and phosphorus deoxidized copper for improved weldability. Other copper and copper alloys can also be produced in the form of clad steels.

Mechanical properties of copper-clad steel are governed by the type of backing steel used. Backing steel may be any of the plain carbon or low alloy steels of flange or firebox quality conforming to ASTM or ASME specifications.

Lukens copper-clad steels can be sheared, formed or rolled according to standard procedures. Uniformity of cladding thickness facilitates fit-up and aids welding.

Lukens copper-clad steels are manufactured by precision assembly of predetermined thicknesses of copper and steel in "sandwich" form prior to heating and rolling, similar to the method used for all Lukens clad steels. This procedure assures accurate, uniform cladding thickness. Rolling the assembly under controlled, even heat and pressure assures components that are permanently bonded into one integral plate. The copper surface is not exposed to the atmosphere during heating, nor is it in direct contact with the mill rolls, assuring a clean, uncontaminated surface.

Lukens Steel Co. manufactures the broadest line of clad steels available, including nickel-clads, stainless-clads, Inconel-clad, Monel-clad and the new copper-clads. First manufactured in 1930, their uses have grown widely since in clad form only a small fraction of high-cost corrosion-resistant metal is necessary to give equipment users the same benefits achieved by using the metal in solid plate form.

(Corrosion Forum continued)

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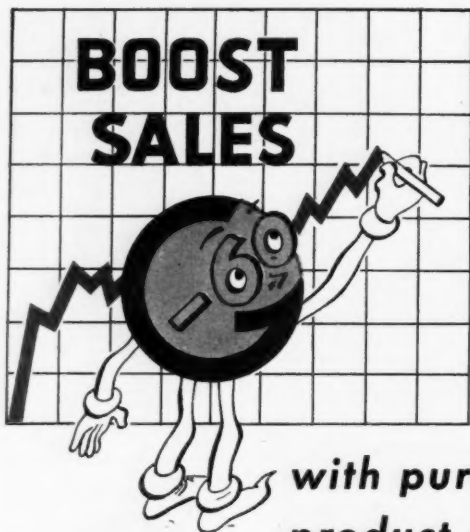
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POLYETHYLENE

Continued from page 262

Principal application of supported polyethylene fabrications can be found in the form of tank linings—both the stationary and removable type. They are gradually finding their way into many varied industries. Chemically, they often exceed other types of tank linings such as hard rubber, neoprene, polyisobutylene, vinyl base materials, and various other corrosion-resistant paints and lacquers. They offer the additional advantages of being white, which may be attractive with respect to cleaning.

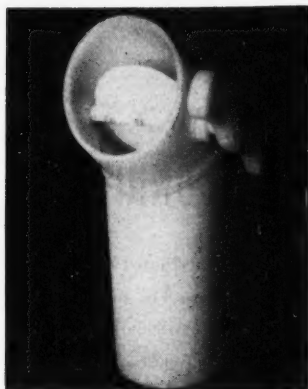
In general it is preferable for such liners, especially those of larger dimensions, to be fabricated at the site of final installation. The flexibility of polyethylene and discrepancies in the dimensions of the tank and the adaptable liner may lead to imperfect fitting, which in turn may have undesirable effects on the liners. Polyethylene liners of extremely large size and intricate design can be secured in position by riveting, screwing, or nailing the liner to the supporting structure and subsequently covering the heads of the rivets, screws, or nails with polyethylene caps. These caps are welded to the liner to insure a leak-proof container.

The plating industry in particular has found these fabricated polyethylene liners to have extremely long life, and their use is being quickly accepted in the textile industry where the storage and handling of bleaching solutions has always presented a problem. Since polyethylene is tasteless and odorless, it has found acceptance in the brewing industry where it is extensively used in pipe lines as well as in lining of storage and fermenting tanks.

PIPE AND FITTINGS

Diameters of polyethylene pipe run up to 6 in. and continuous lengths up to 400 ft. Table II lists the standard sizes of polyethylene pipe available as well as their working and bursting pressures.

As in the case of container fabrication, the hot gas welding method for thermoplastic materials has contributed greatly to the extended use of polyethylene in chemical and related pipe line installations. Completely secure joining of individual pipe sections is attained through weld-sealed ball and spigot type joints and all-welded fit-



Welded 8 in. duct line with damper.

tings. Flanged connections permit connection to existing lines of other construction materials. Polyethylene valves (all polyethylene with the exception of the valve packing) round out the line of polyethylene fittings available today.

DUCT AND EXHAUST SYSTEMS

Polyethylene is of particular interest for use in the construction of exhaust systems carrying corrosive vapors and fumes. Obviously there are limitations in size and temperature, but dimensional limits can be greatly enlarged by proper design of the fabricated sections and by use of supporting members such as steel strapping or even steel or wood sections.

For outside installations, only black polyethylene should be used to improve the weathering resistance. The white material is affected by damaging ultraviolet rays.

SPECIAL APPLICATIONS

Special applications include metering wheels for measuring of hydrofluoric acid, bleach tank covers with custom built attachments, and stirrers using polyethylene-covered steel stems onto which solid polyethylene blades are welded.

REFERENCES

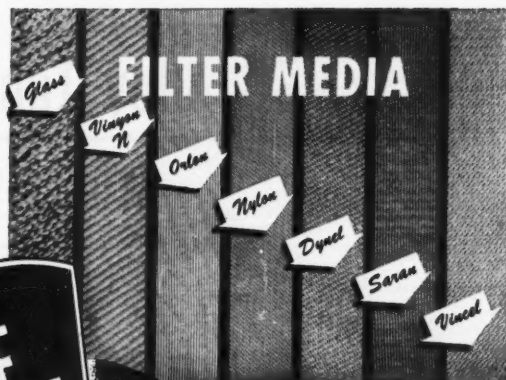
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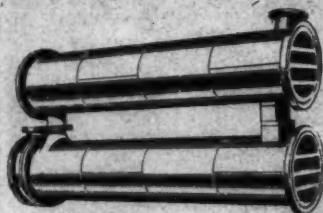
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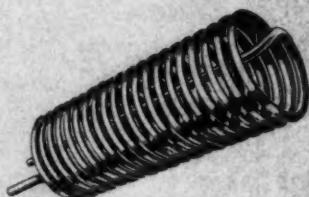
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HAYNES Alloy Tubing

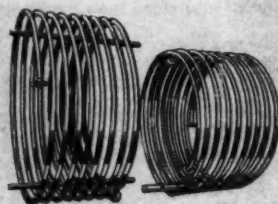
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All four HAYNES alloys are supplied in welded or welded and cold drawn tubing. Most common welding methods—including metallic-arc and HELIARC welding—can be used in fabricating the tubing installations. If you wish further information about HAYNES alloy tubing, contact the nearest Haynes Stellite Company district office.

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HASTELLOY Alloy C (nickel-molybdenum-chromium-iron)	Nitric acid, free chlorine, acid salts, hydrochloric acid, sulphuric acid, phosphoric acid, organic acids, sulphurous acid, high temperatures.
MULTIMET Alloy (cobalt-chromium-nickel-iron)	Oxidation, high temperatures.
HAYNES Alloy No. 25 (cobalt-chromium-tungsten-nickel)	Oxidation, high temperatures, carburization, wet chlorine, nitric acid.

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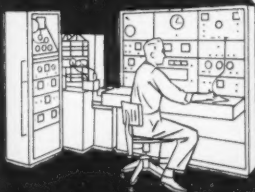
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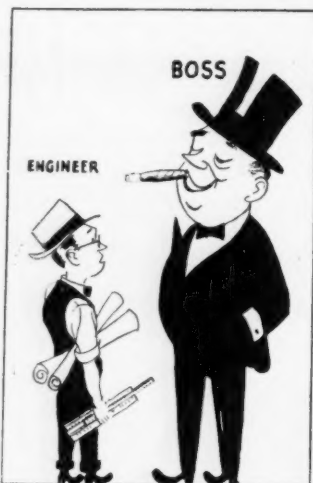
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THIS ISN'T COMMUNICATION



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What's wrong with communications today? Plenty. That's obvious.

► **A New Approach**—What industry needs today is an approach based on common sense and mutual respect all around—from janitor to chairman of the board.

But how can the engineer put a common-sense approach to communications to work?

Let's look at some examples.

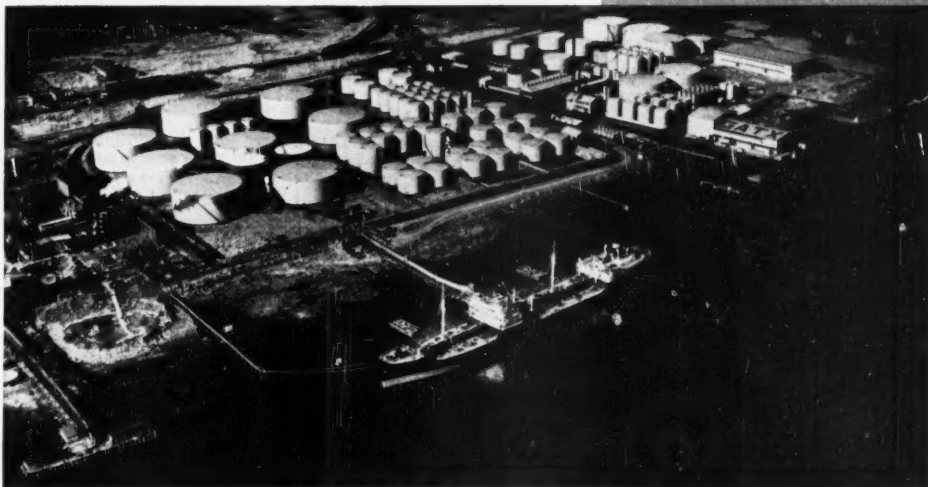
► **A Fresh Viewpoint**—George L. New,* a young employee of the Du Pont Co., has written an excellent paper on communications from the point of view of a recent engineering graduate. In it, he develops the concept of equality. He points out that the essence of communication is sharing. And to share implies equality. He maintains that a sharing of information can only take place in such an atmosphere of equality. He illustrates his point with examples which we quote:

► **How It's Done**—"Let us examine a form of communication that has been functioning since man first learned to speak. It is used by men in all walks of life but hardly recognized for what it is by its commonness. This is the communication that is potentially existent between persons equal in some respect whether it be socially, economically, or circumstantially. It is known by titles ranging from bull session to seminar. It is best explained by examples. Our first is that of the soldier who is assigned to a new outfit and who will, even while he unpacks his bag, look for another soldier having the same rank as himself. When he finds one, whether he be Private, Sergeant, or Captain, he will ask 'What's the deal here?' He will generally be able to learn in one brief and completely unrestricted session all of the pertinent facts about the organization from the Commanding Officer's disposition to leave policies, esprit de corps, and even a good portion of the latest rumors. The soldier would never consider getting his information from a superior or subordinate associate.

"Our second example is one of the passerby who happens upon the scene of an accident and who will in ming-

* See p. 288 for author credit.

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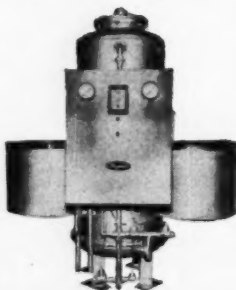
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YOU AND YOUR JOB, cont. . .

ling with the crowd ask another bystander "What happened?" Here again, the desired information is freely and unrestrictedly transmitted. Very infrequently will the passerby attempt to get his information from the officer in charge at the scene.

► **What Makes Communications Click?**—"An analysis of these two explanatory examples will show that in each case there has been an individual with an idea and the desire to share it. There has been another person interested in that idea. Throughout both of these examples the feeling of equality has been predominant and, in no case, does either party hold back in fear of committing a faux pas."

Mr. New points out that just such an approach could be used by industry when hiring potential employees.

The trouble with the traditional interview type of approach is that both the interviewer and the prospective employee are basically unequal, the interviewer being a relatively important officer in the company. Both are on their guard lest one or the other make a misstatement.

As Mr. New puts it:

"As a first step in seeking information about Company A, the graduate will attend a preliminary job interview with a designated representative of the company. In this interview the representative will tell the graduate a bit about the company's products and policies while he is at the same time busily appraising the potentialities of the graduate. During this interview the graduate is usually permitted to ask questions. He may ask questions, but—and the but is important—he generally feels that his questions had better be intelligent ones. A foolish question at this time could easily create a poor impression and hence ruin his chances for employment. The graduate leaves this type of interview thinking not so much of what he has learned about the company, but instead, wondering if he made the grade with the interviewer.

► **What Was Wrong?**—"An analysis of this example made in the light of our previously derived hypothesis will show that even the prerequisites of communication were missing since, although the graduate was interested in receiving an idea, the interviewer was engaged in an assigned task of evaluation and hardly in a position

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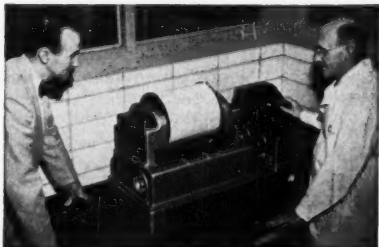
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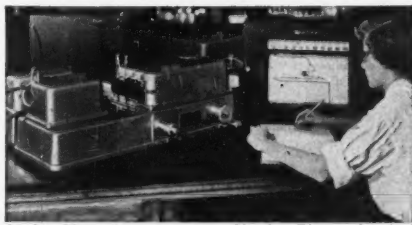
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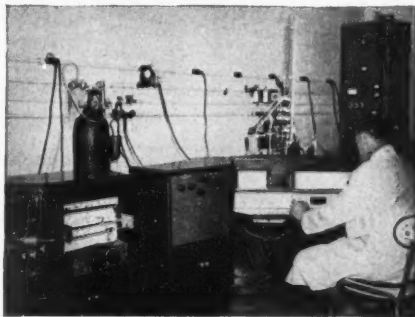
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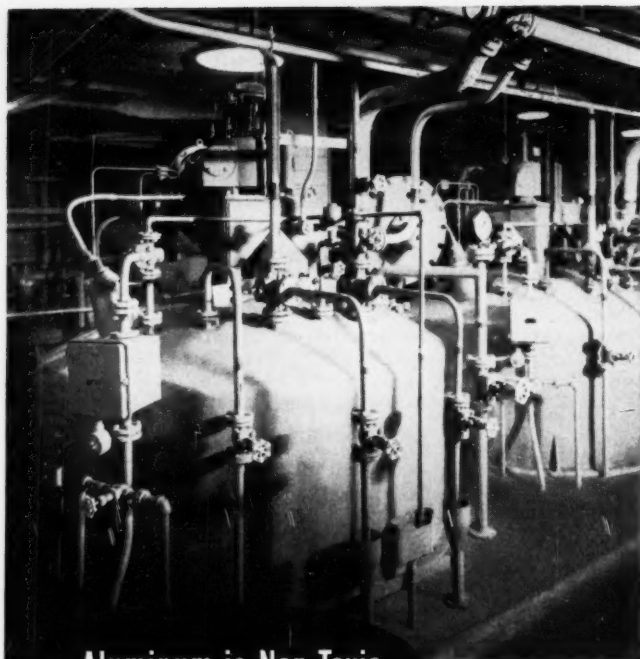


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YOU AND YOUR JOB, cont. . .

to be desirous of sharing an idea. As for the spirit of communication, the graduate could have no feeling of equality while sitting under the spot light of appraisal. Therefore, we can say that if communication existed at all under these circumstances, it was in a restricted and limited state.

► **The Blind Spot**—"Let us examine a second phase and one which is often the final major step in industry's communication with the graduate prior to his actual hiring. We shall assume that he has created a reasonably good impression in the mind of the preliminary interviewer. The graduate is then summoned to the main office of the company where a monetary offer is made for his services. At this time the graduate is told what his new job and duties will be. However, chances are that his attention is quite fixed on the dollar value which has been placed upon his abilities. He is comparing it with other offers or translating it in terms of a new convertible or a home. Frequently the company representative who makes the offer and describes the duty is one who is several years removed from the graduate's potential job. This representative in the past may well have occupied and excelled in the graduate's prospective assignment. Unfortunately the past is long ago and many things have happened in the intervening years. The speaker's memory may be clouded by time. He may gloss over the unpleasantness for the mind quickly shelves these things. He may make his explanation as brief as possible because he has things of greater importance on his mind. Perhaps he just isn't quite sure what it was that he did do in this position.

► **They're Still Fencing**—"Here, as well as in the preliminary interview, the graduate may be permitted to ask questions. Here again the bugaboo of the foolish question arises and the feeling that it would be unwise to create a poor impression on one so high in the company's hierarchy. Although the graduate leaves this interview with definite knowledge of what his compensation will be, quite likely there will be a bit of doubt in his mind about his new duties.

"Here another analysis may be made. The two prerequisites of communication have been filled. The company's representative did have an idea and the desire to transmit it. The

graduate was interested in receiving that idea. It was apparent, however, that there could be little feeling of equality under these circumstances. Therefore, we can say that communication did exist but in a somewhat restricted and limited state."

Mr. New suggests, as a solution, a novel experiment tried by Du Pont.

► **Du Pont Lifts Smoke Screen**—"Job applicants who had passed through the preliminary interview phase at Du Pont were invited to the main office for further interview. At this time they were introduced to other recent graduates who are members of the company and who are doing, as nearly as possible, the same type of work that the applicant will be doing if and when employed. Now we have the following condition:

1. Two persons of a similar educational background;

2. Two persons with relatively the same age and experience;

3. These two persons are sharing a common interest in the same job.

"In order to remove the foolish question bugaboo, both parties are made to understand that no questions asked or statements made during their discussion will ever find their way back to management. The applicant is given to understand that the employee who is to act as the transmitter will in no way be called upon to evaluate him. The employee is made to understand that he is free to give whatever reasonable time is required for the transmission of ideas and that whatever job he is doing at the time will wait.

► **Now There's Contact**—"Under these circumstances most of the normal barriers to occupational communication have been removed. The questions which arise in the mind of every job applicant can now be expressed. Even ones which would normally seem to have little bearing on an occupation but can and do assume great importance in the mind of the newcomer can be answered. Some of the questions, for example, that have arisen during these discussions are these: What kind of a person is your boss? How difficult is it to find housing in this area? Just what kind of work are you doing now? What are your future possibilities with the company? Does someone breathe down your neck to keep you on the job? Is there any definite training program on your job? And many questions including vague rumors that begin "Is it true that . . .?"

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YOU AND YOUR JOB, cont. . .

► **And No Bugaboos**—"To answer questions that involve an honest opinion is not at all difficult under the previously mentioned conditions of equality. Questions about the job are best answered by showing the applicant the job that was in progress when he came in or by introducing him to other men of the same level and asking them to tell in their own words just what they are presently doing. Questions as to working conditions will answer themselves as the applicant circulates about the various job locations and sees others at work or stopping, for a few minutes, for their afternoon pick-me-up at the coke machines. The rumor questions are perhaps, the least difficult to answer in this atmosphere because the applicant will feel that the employee, will have no personal axe to grind."

But selecting new job applicants isn't the only outlet for the common-sense approach to communications.

► **How Not to Solve A Problem**—Let's look at the example of a company with the problem of disgruntled employees. The first act of this comedy opera opens in the offices of XYZ company's top-echelon management.

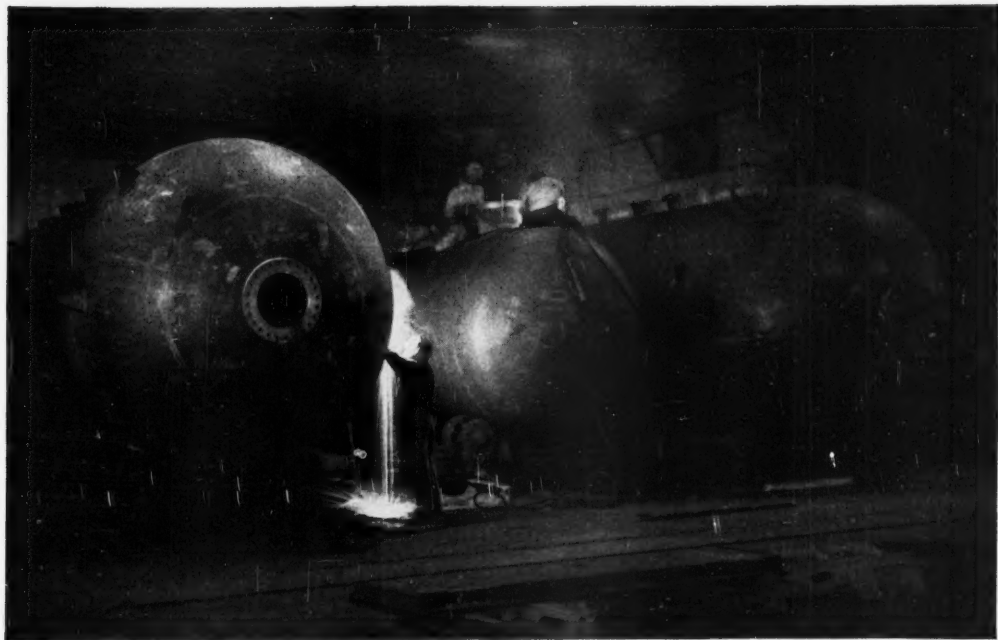
Rumors of discontent in the plant have just reached the ears of these managers. The grapevine doesn't say much more than the fact that there's more grumbling than usual.

► **Quiz the Wrong People**—So top management goes into a huddle, calls in the middle-management group.

They ask these supervisors what's wrong. They may never consider the fact that maybe these in-between supervisors, themselves, are the source of the trouble. Maybe some of these men have become martinets, others have shown unfair favoritism, or have departed in other ways from the rules for dealing fairly with employees laid down by the founder 150 years ago.

So what happens next? Top management decides that employee education is what's needed. "We have to tell the man in the plant what a fine company XYZ is to work for."

► **Pass the Buck**—The next step is to call in an industrial psychologist. He doesn't know the situation that exists so he agrees that employee education is what's needed. But, he points out that the thing to do is to get down to the employee level. "They've got twelve-year-old intelligence so we'll do our story in comic book form keep-



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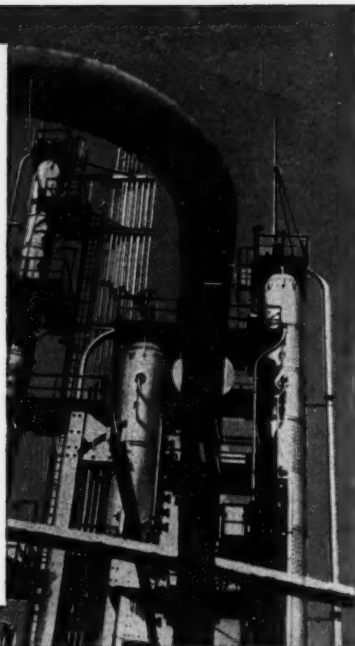
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YOU AND YOUR JOB, cont. . .

ing it below the Flesch Readability Scale for 12-year-olds."

► **Sanction the Wrong Answer**—What happens when the employee gets these "comic books"? The rift between him and management grows wider, the grumbling increases, production falls off and good men quit.

What was wrong?

► **No Forethought**—Was common sense used? No. There was no attempt to get to the heart of the problem to begin with.

Was equally considered? No. No attempt was made to communicate with the workers in any way. The immediate thought was to "propagandize" them.

► **Would This Be Better?**—How much more intelligent it would have been to assume the workers had legitimate gripes and to try honestly to find out what they were.

Maybe if an understanding supervisor called in some of his foremen to talk and listen man-to-man, he would have learned plenty.

He might have found out, for instance, that the worker spoke of his company as a vague "they" or "those guys in the front office," not as "we" and "us." Such a reaction alone would have told him that all the propaganda in the world wouldn't change this man's mind.

It would be much wiser, in this case, to spend the propaganda money to find out why this man and his associates say "they" instead of "we." Then something positive could be done about the problem.

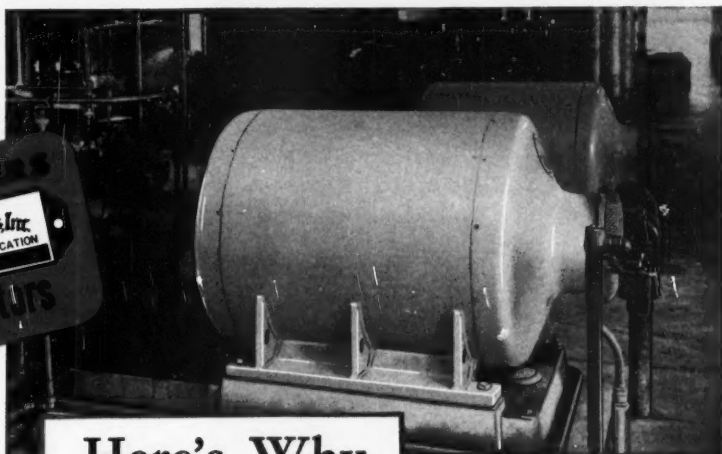
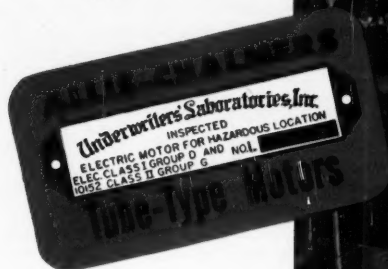
We could find many similar examples throughout industry in every facet of communications from passing ideas up and down the line to management's relations with the labor union.

The important point to be brought out is that we ought to forget the fine points of psychology, mass behavior and complex analyses of communications itself. Instead management has got to come out of the paneled offices, don a pair of overalls and get alongside of the man who turns the valves. Then we may begin to understand this complex problem of communications.

New, George, L., "Communication from the Point of View of a Recent Engineering Graduate." Presented before the Relations with Industry Division of the American Society for Engineering Education at Dartmouth College, Hanover, New Hampshire, June 26, 1952.

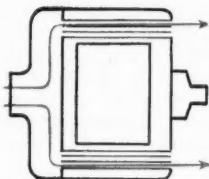
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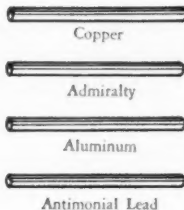
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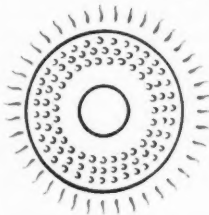
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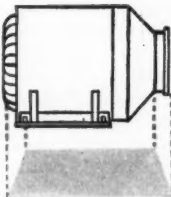
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A-3857

ALLIS-CHALMERS





MAN OF THE MONTH: Kenneth M. Watson

A triple-threat man—educator, consultant, inventor—now heads Pure Oil Co.'s Research and Development Labs. at suburban Crystal Lake, Ill.

Logical though the research mind is, it finds getting settled in a new job, home and travel routine tough to cope with. We hated to intrude at such a busy time, but finally found out Dr. Kenneth M. Watson would be glad to meet us at our booth at the National Chemical Exposition.

Little questioning was necessary. Accustomed to dealing with first things first, Ken brought us from his boyhood in Wisconsin to the present date. In the process a lot of the very human traits of Watson, the man, came to light.

Ken grew up on the banks of the Lemonwien river (a tributary of the Wisconsin river). He recalls that his greatest pleasure was hunting ducks before going to school in the morning. Today he continues this sport by shooting ducks from his front porch in Lake Zurich, Ill.—explaining that his farm is on a flight path between two small, neighboring lakes. Pheasant also abound in the fields of his farm.

Since the Dairy State boasts an excellent chemical engineering school at the University of Wisconsin, Ken stayed close to home for his B.S. and M.S. His first and last venture into the world of music occurred then—playing French horn in the university band. Ken frankly admits that his sole purpose was getting into football games free and feels sorry for the bandmaster since his "trotting was sub-par."

After receiving his degrees he joined Hawthorne Works of Western Electric Co. (in Chicago) as an assistant in engineering development. In 1926 he returned to the

University of Wisconsin to teach chemical engineering and added Dr. to his name in 1929.

In 1931 he joined the staff of Universal Oil Products' Riverside Laboratories in charge of pilot plant and physico-chemical research, was later appointed director of engineering research.

Dr. Watson's contributions to our war effort were many. In 1941, as a member of Gulf Oil Corp.'s engineering staff, he headed the technical committee for the Neches Butane Products Co., Port Neches, Tex. This was a war project in our synthetic rubber program operated by five petroleum companies.

In 1942 he returned to the University of Wisconsin as research professor of chemical engineering in the graduate school. Meanwhile he also served as a consultant to the War Production Board, Office of Rubber Reserve and technical advisor to the President's interagency committee on carbon black in the crisis of 1945. He also served several industrial clients.

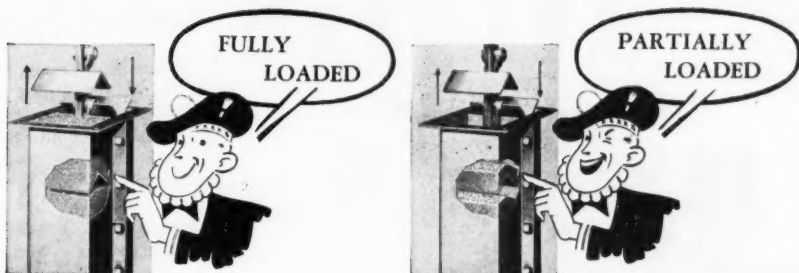
Teaching hasn't been Ken's only educational contribution. He has authored four engineering texts. During the busy war years he coauthored a three-volume series, "Chemical Process Principles," widely used as texts and reference works. In 1948 he received the AIChE William H. Walker Award for "outstanding contributions to chemical engineering literature."

Ken was a consultant from 1950 until taking his new post with Pure Oil. During this time he qualified as a bona fide ocean voyager—making a trip to England every four months for a client. A versatile amateur photographer (running the gamut from 16 mm movies to various sizes of stills, black and white to color), he is most proud of his success in fully covering the pomp and circumstance of the recent Coronation.

Ken also gives a good deal of time to the problems of administering a 140 acre farm at Lake Zurich. He believes the suburban location of the laboratories (40 miles NW of Chicago) is much more conducive to research than a city locale, but admits he may be biased—having never been an urbanite. Though his farm is 15 miles from the lab, it's only a few minutes on the open road. Being snow-bound is no worry to this native Wisconsin though it would undoubtedly cause a city man some alarm. For example, one night last winter he was snowed out on coming home—could only reach an outlying farm building by auto. But a tractor managed to get him across the fields to his home.

Ken describes his wife as "an Irish gal with considerable zip" and wants to name the farm in her honor. Though still undecided it's a toss-up between "Irish Acres" and "Donnybrook Farm." His 21-year old daughter is a geography major at the University of Miami. Ken confided that if we promised not to let her get wind of it, he thinks geography is the easiest way to a degree in Matrimony. Ken himself is a Scot and has heard that the Watson clan has an authentic tartan. He adds that if engineering ever palls he intends to have a suit made of this tartan and get a job in Chicago's Buttery.

(Personals continued on page 292)



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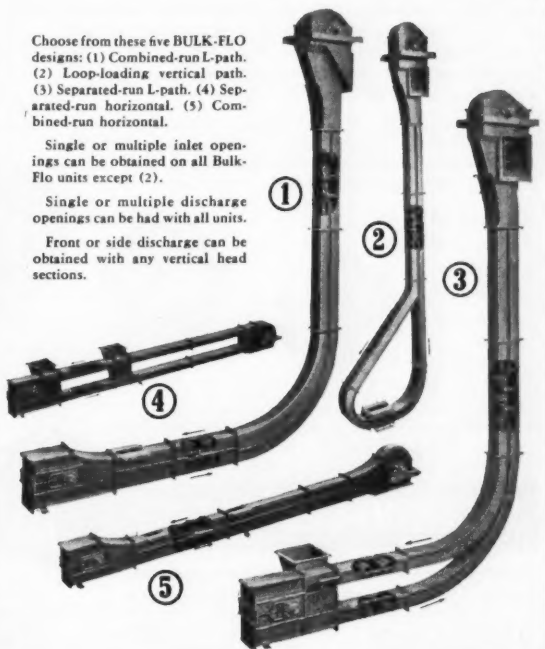
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Choose from these five BULK-FLO designs: (1) Combined-run L-path. (2) Loop-loading vertical path. (3) Separated-run L-path. (4) Separated-run horizontal. (5) Combined-run horizontal.

Single or multiple inlet openings can be obtained on all Bulk-Flo units except (2).

Single or multiple discharge openings can be had with all units.

Front or side discharge can be obtained with any vertical head sections.



LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities.



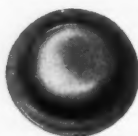
ODS Diaphragm SLURRY PUMP

**Every Contact Inch
Highly Corrosion Resistant**

ODS Pumps are available, of course, unlined for handling non-corroding slurries or solutions but when protection is necessary, all contact surfaces are lined with rubber or neoprene.

So, if you have a pumping problem that calls for a diaphragm pump—regardless of the pH involved—get all the facts about the O.D.S. It can handle just about any slurry or solution found in industry. And it has one of the best low-maintenance features to be found among all pumps: a no-linkage, hole and slot-free diaphragm. Compressed air or vacuum actuates the diaphragm.

Our Bulletin 309-R—recently issued—gives all the latest details about the O.D.S. Pump. In writing for a copy, tell us about your pumping problem. We have a line of acid-handling centrifugal pumps, too—the Olivites.



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A. R. Duval

WEST INDIES

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SOUTH AMERICA & ASIA

The Darr Co., Stamford, Conn.

AUSTRALIA

Hebert Duff Pty., Ltd. Melbourne

SOUTH AFRICA

E. L. Soteman Pty., Ltd. Johannesburg, Transvaal

NAMES IN THE NEWS, cont. . .

Arthur R. Cripps. Development chemist for Plastic Film Co., Plainfield, Conn. Has been chief chemist for Paulsboro Mfg. Co., Fullerton, Pa., floor covering manufacturers.

Ernest Hart. Executive vice president of Food Machinery & Chemical Corp., New York, in charge of supervising and coordinating the operations of all company chemical divisions. Formerly a vice president of FMC and president of its Niagara Chemical Division.

Eugene D. Witman. Manager of agricultural chemical development, Columbia-Southern Chemical Corp. With the company for three years as agricultural chemical specialist in the market research and development department. Previously with Sherwin-Williams as assistant director agricultural chemicals division. Doctorate from Ohio State.



E. D. Witman



Jesse Werner

Jesse Werner. Director of commercial development of the General Aniline Works Division of General Aniline & Film Corp. Has been technical assistant to the vice-president in charge of operations. Came to GAF in 1938 as assistant manager, process development department of its Grasselli, N. J., plant. Doctorate from Columbia.

John R. Skeen. From director of the market research department of Foster D. Snell to vice president in charge of research and development of Nuodex Products Co., Elizabeth, N. J. Continues as an industrial specialist with the economic review staff of NPA and as director of the Chemical Market Report, a Foster D. Snell publication.

Thomas B. Drew. New member of AEC's committee of senior review-

ers. Head of the department of chemical engineering, Columbia.

C. Fred Gurnham. Head of the department of chemical engineering at Michigan State College. For the past four years, head of the chemical engineering curriculum at Tufts. Studied at Yale and NYU.

Robert K. Mueller. From assistant general manager to general manager of Monsanto's plastics division. Came to Monsanto in 1935 as a control chemist at its John F. Quency plant; transferred to the company's plastics division at Springfield in 1939; manager of the division's East plant, 1946; assistant production manager, 1947, and later production manager.

William S. Vaughn. First vice president of Tennessee Eastman Co. and of Texas Eastman Co. Has been a vice president and assistant general manager of Eastman Kodak Co. A new vice president of Tennessee Eastman: **Fred R. Conklin** who continues as works manager of the company's plant in Kingsport, Tenn.

Lester D. Berger. Assistant to the general manager at Carbide and Carbon transferred to New York to work in the company's fine chemicals division. Has been at Oak Ridge working directly under the general supervisor for Carbide operations.

Harold B. Freeman. Executive chairman, reinforced plastics division of the Society of the Plastics Industry. With the plastics department of American Cyanamid Co.

John W. Andersen. Group leader in charge of the chemical engineering research section of Monsanto Chemical Co.'s central research department in Dayton, Ohio. Joined Monsanto in 1949. Doctorate from the University of Wisconsin.

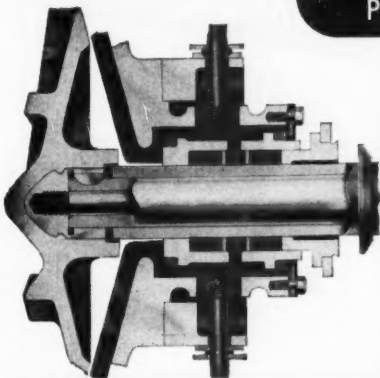
L. K. Scott. Manager, technical division, Devco & Reynolds Co., Louisville, Ky. Formerly director of laboratories of the Jones-Dabney Co., a division of D & R. Joined Jones-Dabney 23 years ago as research director. Studied at the University of Kansas and Lehigh.

OLIVITE

Acid-Handling

PUMP

How It Answers the Problem of Leakage



Illustrated is the stuffing box assembly of the Olivite Acid-Handling Pump.

Since pump leakage is probably the Number 1 Enemy when handling corroding solutions, note how in the Olivite Pump, extra precautions are taken to prevent leakage:

- 1 The stuffing box floats on two rubber rings which permits shaft and packing movement. The packing is not crushed nor is the replaceable shaft sleeve scored.
- 2 The lantern ring permits circulation of the lubricant, water, solution, or grease.
- 3 The resilient packing is of acid-resisting material styled for long life.
- 4 Simple spring loaded wing nut adjustment permits application of correct and proper pressure by the yoke on the gland and packing. No "monkey" wrench required.

Thousands of Olivite Acid-Resisting pumps have been supplied the Process Industries during the past 20 odd years. The values of these years of design, manufacturing and operating experience are embodied in every 1¼", 2" or 4" Olivite Pump you purchase. Bulletin 308-R provides full details. When writing us please outline your pumping problems.

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ALUMINUM AND STAINLESS STEEL

are fabricated by Littleford to care for the ever-increasing need for specialized equipment in the Chemical Industry. Equipment that is strong, tough and resistant to corrosion.

To produce this type of product takes the skill of craftsmen who have had experience in laying out, shearing, forming and welding of Alloy Metals. Littleford had this

experience and has produced equipment from Stainless Steel, Monel, Nickel, Aluminum, Everdur, and Inconel since their inception. Tanks (Plain and Code), Bins, Vats, Kettles, Tables, Troughs, Hoppers, etc., are only a few of the many products now in use.

70 years' experience in the fabricating of metals plus a definite responsibility for the finished product is why Littleford can offer a service which is second to none.

If you have a problem involving Alloy Metals send blueprints to Littleford, see for yourself how these years of fabricating know how can cut your costs for specialized equipment. Send for Alloy Fabricating Bulletin.



LITTLEFORD

LITTLEFORD BROS., INC.
421 E. Pearl Street, Cincinnati 2, Ohio

NAMES IN THE NEWS, cont.

John R. Bates. Technical adviser to the executive committee of Sun Oil Co.'s board of directors. For the past five years, head of research and development activities. With the company since 1942. His successor: **J. Bennett Hill** who joined the company in 1934 to head up chemical research and development at the Marcus Hook, Pa., refinery.

Harry C. Martin. A vice president Carborundum Co., Niagara Falls, N. Y. Continues as director of research and development. Joined the company's research laboratory in 1913; assistant technical director, 1944; technical director, 1947. Graduate of the University of Toronto.



Harry C. Martin




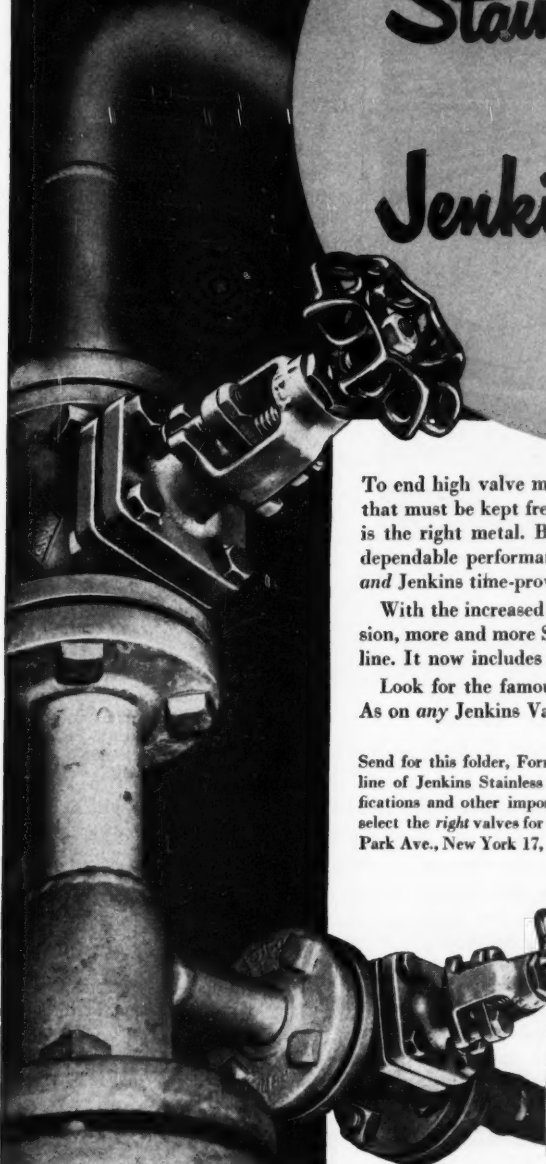
W. I. Shaw

W. I. Shaw. General manager, coordinator of production, technical research and development, Central Paint & Varnish Works, Brooklyn, N. Y. Has been plant superintendent.

L. C. Brunstrum. Section leader, at the Whiting, Ind., laboratory of Standard Oil (Indiana), research department. **H. J. Liehe,** group leader, greases. **A. W. Lindert,** section leader, and **R. S. Barnes,** group leader, industrial lubricants. **T. B. Tom,** section leader, and **R. A. Hunt,** group leader, light oils. **R. A. Dinerstein,** group leader, fractional distillation and hydrocarbon analysis. **M. Den Herder,** group leader, catalyst research.

M. Gordon. Section leader, light and heavy oils finishing and asphalt manufacture, technical service division, Standard Oil's (Indiana) Whiting, Ind., laboratory. **W. E. Stanley,** group leader, light oils finishing. **R. B. Selund,** section leader, distillation, coking, heavy oils processes and acid manufacture. **W. E. McGinnity,** group

Here's the hookup
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Stainless Steel PLUS Jenkins Quality

To end high valve mortality from corrosive liquids, and to control fluids that must be kept free from contamination or discoloration, stainless steel is the right metal. But it takes more than metal to make a valve. For dependable performance, you need the two-way hookup—Stainless Steel and Jenkins time-proved Valve Engineering.

With the increased demand for processing equipment that resists corrosion, more and more Stainless Steel Valves have been added to the Jenkins line. It now includes types and sizes to meet most industrial needs.

Look for the famous Diamond trade-mark on valves of stainless steel. As on *any* Jenkins Valve, it means extra years of trouble-free service.

Send for this folder, Form 194, describing the complete line of Jenkins Stainless Steel Valves. It contains specifications and other important data that will help you select the *right* valves for your plant. Jenkins Bros., 100 Park Ave., New York 17, Jenkins Bros., Ltd., Montreal.



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a 900,000 gallon-per-hour problem!



Largest installation of its kind in the world, this sedimentation unit handles 900,000 gallons per hour.

Problem was to clarify phosphate rock tailings carrying 2% solids — on a budget. Our answer, after thorough field study and testing, was this special 300 foot dia. Dorr Thickener mechanism installed in a 750 foot earthen basin. The results — economically accomplished — are an overflow suitable for re-use and an underflow thickened to 12-15% solids which can readily be impounded.

And sedimentation isn't the only unit operation where our specialized equipment and knowledge pays off.

Regardless of whether your process involves the separation of finely divided solids in suspension, the use of ion-exchange or fluidizing techniques, we can provide the right equipment for your specific job. **THE DORR COMPANY**, Barry Place, Stamford, Conn.



Better tools TODAY to meet tomorrow's demand

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NAMES IN THE NEWS, cont.

leader, heavy oils processes and acid manufacture.



G. A. Nelson



J. M. McWhirter

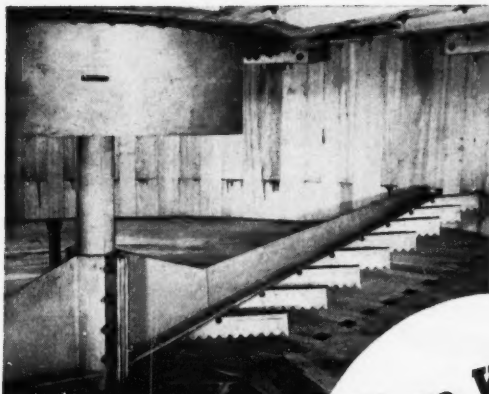
G. A. Nelson. Assigned to electrochemical engineering consulting work in connection with Pennsalt's current expansion and plans for future developments. Has been manager of the company's Wyandotte Works. His successor: **James M. McWhirter**, formerly southern works manager. Came to Pennsalt's Natrona, Pa., plant from General Chemical Co. in 1945, made superintendent in 1946. Became first superintendent of the company's hydrofluoric and sulphuric acid plant at Calvert City, Ky. Superintendent of Pennsalt's new electrolytic chlorine, caustic soda and hydrochloric acid plant now under construction at Calvert City: **Herman J. Eichenhofer**, formerly assistant superintendent at Wyandotte.

Louis B. Taylor. To specialize on work related to the pulp and paper industry, market research and development department, Columbia-Southern Chemical Corp. With the firm since 1939. Previously a technical assistant with the Institute of Paper Chemistry.

Philip J. Lowry. Section chief at the Mound Laboratory, Miamisburg, Ohio, operated by Monsanto for the AEC. Has been operating supervisor since 1947. His successor: **Bernard E. Baughn**, formerly operating chemist.

K. D. Morrison. Vice president in charge of sales, Summers Fertilizer Co. Formerly, president of Naco Fertilizer Co. Prior to that, vice president of the Davison Chemical Corp.

A. S. Burhans. Assistant director of research, Beech-Nut Packing Co.,



Interior of a special Dorr Thickener, equipped with rubber-covered mechanical and spiral rain blades. Lead-covered steel, steel and stainless steel balls have also been fabricated.

A special 200 ft. dia. Dorr Thickener equipped with rubber arms and a floating oil bedwork installed in a 750 ft. dia. settling basin clarifies 15,000 gpm of pulp slurry each day.



The Thickeners are covered with a rubber and have automatic drainage lines in a sludge handling plant. Covered Dorr Thickeners are also used in the aluminate industry where they produce sodium silicate.

One of the largest water recovery plants in the world has three 250 ft. dia. Dorr Thickener installed in a single settling basin. Almost 5 acres of surface area is covered with a capacity of 140 million gallons per day.

Have You a **SPECIAL** Thickening Problem?



Many thickening problems in the process industries can't be solved by standard methods. It's here that Dorr's ability to provide a special unit, tailor-made for the special job, pays dividends. Here are four recent examples. If your problem requires a fresh approach, why not check

Dorr . . . the oldest manufacturer of sedimentation equipment . . . *with the newest ideas*. Write for your copy of Bulletin No. 3001 "Dorr Thickeners for chemical, metallurgical and industrial processing." The Dorr Company, Engineers, Stamford, Connecticut.

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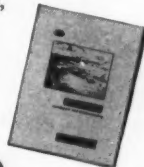
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MODEL
 30-B

No. 2 of a series of 6

NAMES IN THE NEWS, cont.

Canajoharie, N. Y. Formerly head
 of the company's polymer and gum
 laboratories. Prior to joining
 Beech-Nut in 1947, with the re-
 search and development group, pro-
 tective and decorative division,
 Bakelite Corp. Studied at Oberlin
 and Duke.

Henry F. Palmer. A vice president,
 Kentucky Synthetic Rubber Corp.
 Has been manager of the company's
 Louisville plant. His successor:
 Howard R. Erwin, formerly direc-
 tor of engineering. New associate
 plant engineer: Howard W. Cable.

Gilbert J. Straub. Director of product
 development, Harrower Laboratory,
 Inc., Jersey City, N. J. Has been
 chief chemist for six years. Pre-
 vious employers: General Foods,
 William R. Warner and Co., Ad-
 vance Research Clinical Labora-
 tories. Rutgers graduate.



Gilbert J. Straub



V. E. Wellman

V. E. Wellman. Assistant manager,
 intermediate and rubber chemicals
 department, Calco Chemical Di-
 vision, American Cyanamid. Joined
 Calco in 1945, since 1951 has been
 director of process engineering.
 Previous positions: research chemist
 then director of purchases, chem-
 icals division, B. F. Goodrich Co.;
 assistant sales manager, solvents de-
 partment, R. W. Greff Co. Doc-
 torate from the University of
 Washington.

LeRoy M. Shanaman. Chief of the
 inorganic and agriculture chemicals
 branch of the chemical division of
 NPA. On leave as sales manager for
 Pennsalt of Washington, Portland,
 Ore.

Leland Stewart. Assistant professor
 of chemistry, Wagner College,
 Staten Island, N. Y. Previously
 with Du Pont for 18 years and
 American Cyanamid for 6 years.

Case History #23

Or the Obnoxious Catalyst and How It Was Made

A HYDROGENATION catalyst presented many difficulties to a chemical manufacturer who was producing the catalyst for their own use. It was hazardous and costly to produce . . . valuable space and equipment needed for regular plant production was being monopolized.

Having heard of the confidential and dependable manner in which Davison produced specialty catalysts this company turned to Davison's Field Service Engineers for help. Davison Research then took over and soon the catalyst was being turned out by a pilot plant operation. Then an initial plant run was made.

Not only did Davison's experience and modern facilities produce the catalyst at a reduced cost but the efficiency of the catalyst was also increased. The production of this hydrogenation catalyst by Davison know-how eliminated the dangerous plant problem and enabled the chemical manufacturer to utilize valuable space formerly used to manufacture the catalyst.

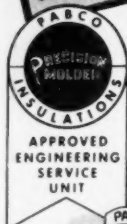
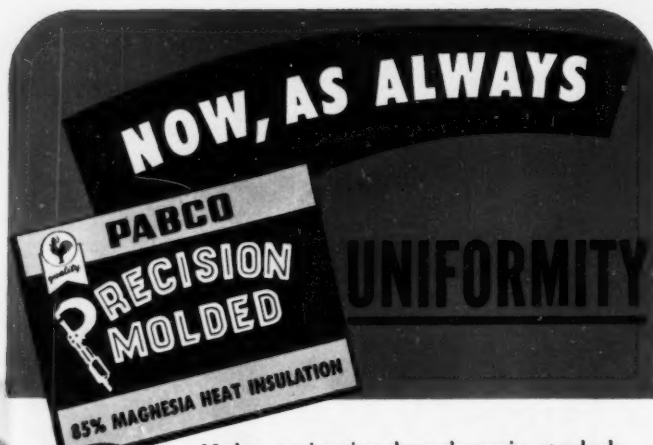
If you have a catalyst problem, why don't you contact the Davison Field Service Engineer or the Technical Service Department and put Davison Research to work for you.

Progress through Chemistry

THE DAVISON CHEMICAL CORPORATION

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PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK,
SILICA GELS, SILICOFLOURIDES AND FERTILIZERS

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Modern engineering demands precise standards of heat insulation performance. Pabco *Precision Molded 85% Magnesia* combines the time-tested superiority of Magnesia with precision molding to give you a light weight insulation manufactured to very close tolerances.

LIGHT WEIGHT

Pabco *Precision Molded 85% Magnesia* weighs just 11 lbs. per cubic foot. In addition to its light weight, it also brings many timely advantages, including easy application and greater rind strength.



Simpler and easier to apply!
Easier to lift, cut and score.
Simpler to imbed tie wires
flush in the surface, too!

CLOSE TOLERANCES

Pabco's plus tolerance is only $\frac{1}{2}$ lb. per cubic foot! This means an amazing degree of control over such factors as Weight and Thermal conductivity. Other controlled factors include size, thickness and uniform fibre distribution.



Precision pipe fit! Both pipe coverings and blocks are molded to exact final size and thickness, not molded oversize and then "milled" to size.



THE DEPENDABLE STANDARD — "MODERNIZED"

PABCO PRODUCTS INC.

INSULATION DIVISION

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Manufacturers of Heat Insulation
Since 1920

PABCO ENGINEERING SERVICE UNITS IN ALL PRINCIPAL CITIES

NAMES IN THE NEWS, cont. . .

H. Darwin Kirschman. Research chemist, Truesdail Laboratories, Los Angeles. Formerly a lecturer in chemistry at the University of California, Los Angeles. Doctorate from California Institute of Technology.

John M. Deming. New member of the research staff of Monsanto's organic chemicals division in St. Louis, Mo. Transferred from the company's central research department at Dayton, Ohio. With the company since 1951. Doctorate from Purdue.

P. S. Willard. In charge of Proctor & Gamble's new soap manufacturing plant under construction in Sacramento, Calif. Since 1947 has been superintendent of process division and production division at Ivorydale, Ohio. Joined the company's main laboratories in Ivorydale in 1930. Named superintendent of the Macon, Ga., plant in 1945.

Louis Lykken. Manager of technical service for Julius Hyman & Co., Denver. Has been assistant head of the analytical department for Shell Development Co. for the past 8 years.

Alfred J. Munday. Retired as Chicago branch manager, Kinney Mfg. Co., after 35 years in the post.



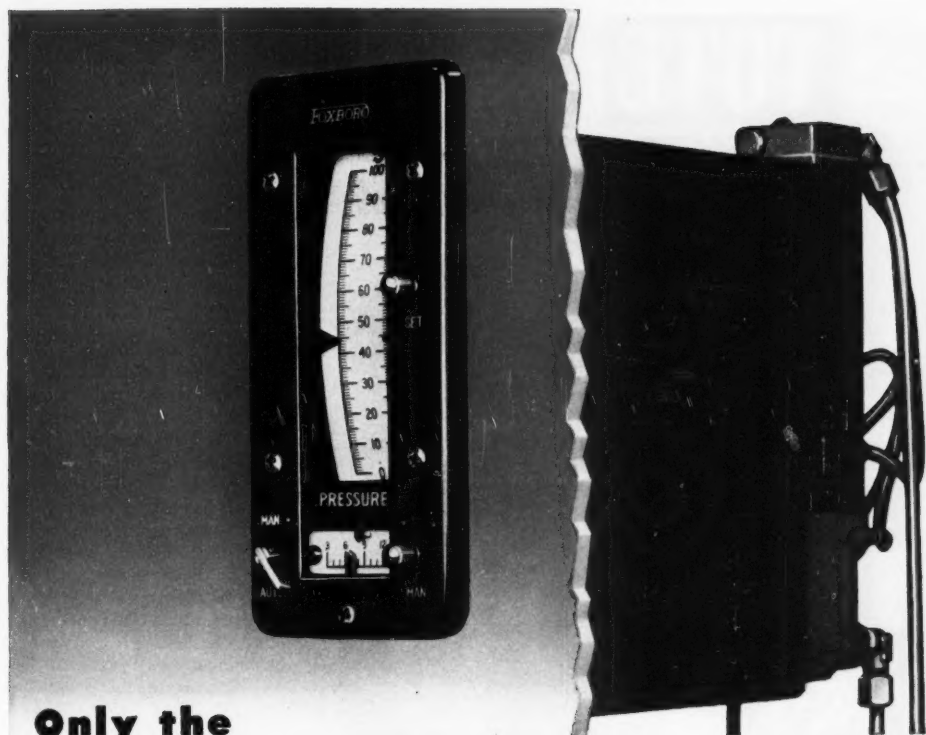
H. P. Hood



M. E. Nordberg

Harrison P. Hood and Martin E. Nordberg. To receive John Price Wetherill Medals from the Franklin Institute for their discovery of a new process for manufacturing unusual, high silica glasses. Both are research chemists for Corning Glass Works, Mr. Hood since 1920, Mr. Nordberg since 1929.

J. William Harlow. Production superintendent of the Fort Erie, Ont.,



Only the
CONSOTROL M/52
gives you all these advantages!

For indicating control functions in your console or graphic panel instrumentation, no other controller offers so much for so little money as the Foxboro Consotrol M/52 Indicating Controller. Compare these combined advantages:

- 1. A completely self-contained, compact, panel-mounted Indicating Receiver Controller** that costs up to 20% less, installed, than usual graphic panel indicating control.
- 2. Simple installation** — only 2 connections besides the air supply.
- 3. Pull-out feature** that provides complete accessibility of control mechanism from front of panel.
- 4. Instrument-type pressure transmitter** for driftless remote manual control, instead of usual pressure regulator.
- 5. Simple 2-position transfer switch** and "fool-proof" transfer indicator provide absolutely bumpless transfer.
- 6. Graphic panel compactness** — takes only $3\frac{1}{4}"$ x $7\frac{3}{4}"$ of panel space.
- 7. "Full-size" performance** — control action unsurpassed by the finest conventional-size controllers. Available in Proportional, Proportional with Reset, Proportional with Derivative, Proportional with Reset and Derivative, and On-Off.
- 8. May be used** with separately-mounted recorder using conventional circular charts. Up to 6 records may be combined on one chart with the Foxboro Multi-Record Recorder. (Consotrol Recorder-Controllers, featuring full scale 4" strip charts, also available.)

Get full details of this space-saving, cost-saving instrumentation. Write for Bulletin 463 describing the complete Consotrol Line of graphic panel instruments. **The Foxboro Company, 3610 Neponset Ave., Foxboro, Mass., U. S. A.**

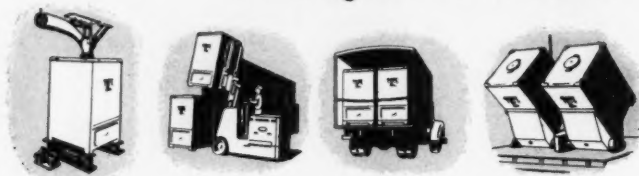
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RECORDING • CONTROLLING • INDICATING
INSTRUMENTS

TOTE

... a **COMPLETE SYSTEM** for
handling bulk materials



FILL **STORE** **TRANSPORT** **DISCHARGE** **BATCH-WEIGH or BLEND**
Automatically Economically Easily Automatically Accurately



- Save time and labor costs
- Save container costs
- Save storage costs
- Save losses due to weather and deterioration
- Save losses due to spillage, sifting and dusting
- Save losses due to rodent and insect infestation
- Save original product quality

EQUALLY EFFECTIVE FOR INTER-PLANT OR IN-PLANT OPERATION

Tote System—built around aluminum bins plus automatic filling and discharging equipment—is now in use in many industries handling a variety of products, both liquid and dry. They include flour, sugar, cocoa, soaps, detergents, polystyrenes, ethocel, phthalic anhydride, whiting, cement and phosphor powders.

In many instances, the savings effected in **JUST ONE YEAR** through Tote System have more than paid for the cost of the installation.

Tote engineers will survey **YOUR** plant to determine the savings **YOU** can effect, at no cost or obligation.

Write for detailed information.

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Reg.
U. S. Pat.
Off.

TOTE SYSTEM, INC.

600 So. 7
BEATRICE, NEBRASKA

NAMES IN THE NEWS, cont. . .

plant of the Amer Co., Buffalo, N. Y. Continues as chief chemist in charge of the control laboratory.

B. C. Rowley. Market research manager, Jefferson Chemical Co. With the company's technical and research department since 1947. Previously a research physical chemist with American Cyanamid. Doctorate from Yale.

Ames B. Hettrick. Manager of the newly formed engineering and development department, Calco Chemical Division, American Cyanamid Co. Has been the division's assistant manager of manufacturing since 1946. Joined Stone and Webster in 1928; to Southern Mineral Products Corp. as chief engineer in 1931 then plant manager in 1934; in 1936 became vice president and general manager, Virginia Chemical Corp. Upon the acquisition of Virginia Chemical's titanium interests by Calco in 1944, became works manager of the Piny River, Va., plant. MIT graduate.



A. B. Hettrick



John A. Scott

John A. Scott. Executive vice president of the newly formed Sinclair Chemicals, Inc. Has been manager of the petrochemical division, Sinclair Oil Corp.

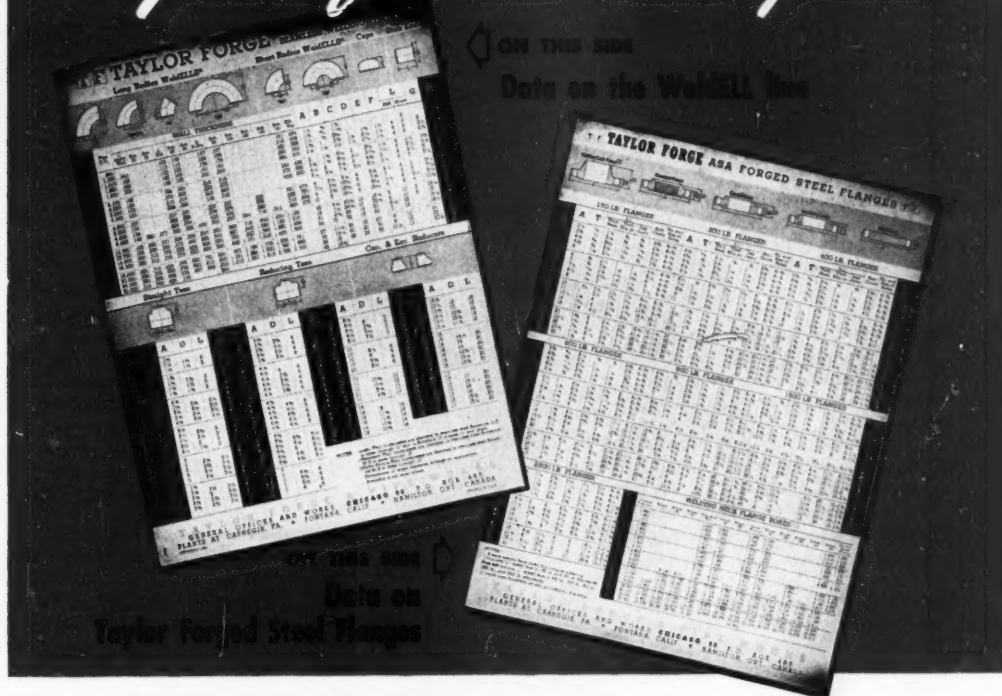
OBITUARIES

Howard J. Cannon, 49, who spent most of his career in research work for Abbott Laboratories, died in Chicago July 24.

Reuben S. Tour, 63, chairman of the department of chemical engineering at the University of Cincinnati, died August 1.

F. A. Abbiati, 47, a vice president of Monsanto Chemical Co. and general manager of its plastics division, died in Boston August 15.

Yours for the asking—



A VOLUME OF DATA

... covering welding fittings and forged steel flanges ...

ON A SINGLE SHEET

Here is just about the handiest tool ever devised for the pipe designer. Data on welding fittings and flanges that otherwise could be found only by plowing through many catalog pages and tables have been ingeniously condensed on the two sides of the durable letter-size card illustrated above.

One side covers the broad WeldELL line of Taylor Forge welding fittings. For every nominal pipe size, $\frac{1}{2}$ " through 30", it shows the wall thickness for every weight of every fitting in every available material. It also shows all required dimensions of all types of fittings.

The other side covers the world's most complete line of forged steel flanges. For every nominal pipe size, $\frac{1}{2}$ "

through 24", it gives all essential dimensional and bolting data for all types of flanges in all weights. A particularly useful table (see reproduction) is that showing welding neck flange bores which enables you to determine the I.D. of any nominal pipe size without separate calculation. Thus the sheet gives you O.D. and I.D. of any weight of pipe.

The card is varnished to make it stand the steady usage you are certain to give it. To obtain your copy see your Taylor Forge distributor or

MAIL THE COUPON.



TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Ill.
Offices in all principal cities.

Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

Please send me one of your fitting and flange sheets

NAME

POSITION

COMPANY

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CITY ZONE STATE

o 513-1152

Industrial Notes

NEW FACILITIES

Atomic Energy Commission—A San Francisco Operations office which brings to nine the total of AEC's principal field administrative centers.

Consolidated Engineering Corp.—New and larger offices in New York for its subsidiary, CEC Instruments, Inc. Walter J. Beagan will be in charge.

University of California, Los Angeles—A \$4.5 million chemistry-geology building, considered one of the best teaching-research plants of its kind in the West.

St. Regis Paper Co., New York—A multiwall bag plant at Tacoma, Washington, which replaces the one the company has been operating at Seattle.

Ferro Corp. of Cleveland—A million-dollar plant in Nashville, Tenn., to specialize in the production of fiber glass for the plastic reinforcement field.

Dow Chemical Inter-American Ltd. and **Dow Chemical International Ltd.**—Eastern offices in New York City.

Arapahoe Chemicals, Inc., Boulder, Colo.—A new warehouse which has raised total plant investment 60 percent with completion of a new warehouse.

Steiner-Ives Co.—A plant at Union, N. J., to increase production of industrial ovens and heat-treating equipment.

Builders-Providence, Inc. and **Omega Machine Co.**—A new office in Kansas City, Mo., headed by Ray W. Lindsey.

Battelle Institute, Columbus, Ohio—A new million-dollar special purpose laboratory building which will enable it to conduct an additional \$2 million worth of research for defense agencies and defense industry.

Westinghouse Electric Corp.'s Sturtevant Division—An expanded air handling department with branch offices in eight new sections: Boston, Philadelphia, Cleveland, Chicago, St. Louis, Atlanta, Pittsburgh, New York.

NEW LINES

Oliver Corp., Chicago—"Black Velvet" gravity conveyors through the purchase of the resources and facilities used by Carter Industries of Cincinnati. The new line will be integrated into the business of the company's Farquhar Division at York, Pa. The company states that this move enables their division to offer the most complete line of conveyors available in the United States.

Precision Paper Tube Co., Chicago—Large size paper tubes for use in large power transformers and similar large coil applications, such as in X-ray and diathermic equipment. Square, rectangular and radiused paper tubes ranging in size up to 9 in. on either side and round tubes up to 9-in. diameter are now available spirally-wound of dielectric kraft, fish paper, cellulose acetate or combinations to lengths as specified.

Drayer-Hanson, Inc., Los Angeles—Aerial coolers and shell and tube heat exchangers for the petroleum and chemical industries through the purchase of Jackson Engineering Co., Los Angeles.

General Electric Co.—Polester resin which is now being produced at its Anaheim, Calif., plant. This is believed to be the first commercial production on the West Coast.

Servotrol Co., Chicago—Precision potentiometers and servo components as a result of a license agreement with Technology Instrument Corp.

Carl H. Biggs Co., Los Angeles—Casting resins and potting compounds developed to meet high-quality needs of military and civilian users.



Eimco Corp., Salt Lake City—Vacuum filters, 100 percent rubber covered. With rubber lined drums, molded rubber wear plates, hard rubber valves, rubber-plastic piping and rubber lined pumps, five of the new filters have been placed in service recently for uranium extraction, zirconium production and manufacture of photographic chemicals. The filters are cheaper than stainless steel filters and can handle materials stainless can't (halogen slurries, for example).

Voss Belting & Specialty Co., Chicago—Teflon coated glass fabrics in the form of conveyor belting. Du Pont has appointed Voss as the first distributor of the Teflon material used in this form.

Bonnot Co., Canton, Ohio—Reciprocating rotary actuators as a result of recent purchase of Hydromotor, Inc.

Eutectic Welding Alloys Corp., ChemoTec Division, Flushing, N. Y.—Organic metallic bonding agents as a result of an agreement with Ciba Co. which pioneered development of these products. The new materials bond metals such as titanium, magnesium, aluminum together with glass, wood, porcelain, plastic. These may be joined to each other or metal may be joined to glass, fabric to metal, or glass to wood.

NEW REPRESENTATIVES

Continental Foundry & Machine Co., Erie, Pa., has appointed Carl Grimes & Co., Des Moines, as representative for its control instruments in the state of Iowa.

Superior Combustion Industries, Inc., New York, has appointed Johnson-Heyck Inc., Houston, as sales rep-



stainless
is
valuable
these days

Since stainless is so valuable, plan to make it go further.

Specifically, this means selecting a grade or finish of stainless that, besides doing the job adequately, will be in less demand than one you have been figuring on.

Here is where Crucible can help you out. The matchless experience of our metallurgists and stainless fabricating specialists can help you get the most out of your share of stainless.

Call upon us to help you.

CRUCIBLE

52 years of *Fine* steelmaking

first name in special purpose steels

STAINLESS STEEL

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.
REZISTAL STAINLESS • REX HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

CHEMICAL ENGINEERING—October 1952

305

from solder manufacturing



to shortening!

wide-awake process men value

DOWTHERM

the MODERN heat transfer medium

DOWTHERM® is efficient! DOWTHERM, with a high coefficient of heat transfer, speeds heating and minimizes equipment size.

DOWTHERM provides flexibility within the operating range. Heat supply to several units at different temperatures is possible, if desired. It also provides a high uniformity of heat control, preventing hot spots and local overheating of your product.

If your operations require precise heating in the 300-750° F. range, write to Dow for complete information about DOWTHERM.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN



THE DOW CHEMICAL COMPANY
DEPT. DO 11, MIDLAND, MICHIGAN
Please send me "The Dowtherm Story."

Name _____ Title _____

Company _____

Address _____

City _____ State _____



INDUSTRIAL NOTES, cont. . .

representative to handle its heat exchangers in the state of Texas.

Hammond Iron Works, Warren and Bristol, Pa., has arranged with Vulcan Iron & Engineering Co., Winnipeg, Manitoba, to make available in Canada all Hammond designs of conservation storage tanks as well as standard API oil storage tanks.

Childers Mfg. Co., Houston, has appointed the following sales representatives for its corrugated aluminum jacketing: Fred W. Koester Co., Milwaukee; Jarvis Equipment Co., Cincinnati; Northern Heating and Insulating Reg'd, Arvida, Que.

United States Rubber Co. has appointed Rubber Fabrics Co., New York, as distributor of its cast vinyl film laminated to knitted fabric that is being produced in the recently purchased Stoughton, Wis., plant.

Warren Steam Pump Co. has appointed Process Industries Engineers, Inc., Pittsburgh, Pa., as representatives for its line of centrifugal, reciprocating and rotary pumps in the Cleveland area.

Control Engineering Corp., Canton, Mass., has appointed Peacock Bros., Ltd., as exclusive distributor in Canada for its line of commercial pressure measuring equipment.

Wyandotte Chemicals Corp. has appointed Talchem, a subsidiary of Transocean Air Lines, San Lorenzo, Calif., as its U. S. distributor with franchise to distribute the products in certain foreign countries. The contract covers products in the aviation, industrial, marine, automotive, manufacturing and food processing fields.

NEW LOCATIONS

Schwarz Laboratories, Inc., has moved its administrative offices and analytical laboratories to 230 Washington St., Mount Vernon, N. Y.

Pfizer Inter-American, S. A., Rio de Janeiro, to process and distribute antibiotics and other pharmaceutical products in Brazil. The new company is a manufacturing sub-

IDEA-PLASTICS

... from Du Pont Polychemicals Department

"ALATHON"*

makes flexible pipe that's light in weight—resists chemicals—won't corrode

Many users of pipe can now profit two ways with pipe made from Du Pont "Alathon" polythene resin.

First, this pipe is quick, easy and economical to install because of the flexibility and light weight of "Alathon." Second, pipe made from "Alathon" is long-lasting because it won't rust, rot or corrode—is unaffected by acids, alkalis and most other chemicals. Also, because "Alathon" is odorless, tasteless and non-toxic, it is ideal for a variety of uses.

Pipe of "Alathon" is being used, for example: to carry water or corrosive fluids, gases, vapors and wastes in plants making paints, dyes or polishes—in coal, salt and other mines—in food processing plants—and for irrigation on farms and ranches.

The outstanding properties of Du Pont "Alathon" are being put to work, too, in flexible bottles, closures, coatings for paper, battery parts, insulation for wire and cable and other applications. Possible new uses



include shoe components, and binders for non-woven fabrics.

Your business, too, may find opportunities for profitable use in Du Pont "Alathon"—or in other Polychemicals products. There are more than 100 of them—amides, alcohols, ammonia, organic acids, resins, esters, solvents and plastics.

*Reg. U. S. Pat. Off.

Write for technical booklet on Polychemicals products for your industry

Technical bulletins on "Alathon" polythene resin and the chemicals and plastics used in your industry are available. Each product bulletin in the booklet presents physical and chemical properties, description, specifications, uses and possible applications, bibliography and other data. Write us on your business letterhead for your copy—and please tell us the type of application that you have in mind.

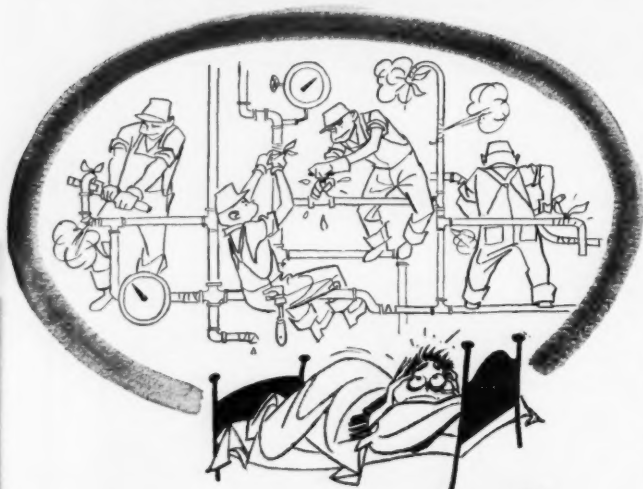
E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department, 1510E Nemours Building
Wilmington 98, Delaware



150th Anniversary
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

Say goodbye to nightmares about pipe repairs and replacements!



Install corrosion-resistant saran lined steel pipe wherever you are piping chemicals and solvents. Because saran is extremely resistant to most chemicals and solvents, such installations will give dependable, long-term service and reduce shut-downs due to pipe repairs and replacements. In addition to minimum maintenance cost saran lined steel pipe brings you another important advantage: it is easily field fabricated. No intricate tools required, no waiting for special fabrication, no costly delays. Saran lined steel pipe is manufactured by The Dow Chemical Company.



Write to the Distributor:

SARAN LINED PIPE COMPANY

2415 BURDETTE AVENUE • FERNDALE, MICHIGAN

Offices in: New York • Boston • Pittsburgh • Tulsa
Philadelphia • Chicago • Portland • Indianapolis • San
Francisco • Houston • Denver • Los Angeles • Seattle
Cleveland • Charleston, S. C. • Toronto • Montreal

clip and send today!

Saran Lined Pipe Company,
2415 Burdette Avenue, Ferndale, Michigan
Please send me a copy of your catalog on
Saran Lined Pipe, Valves and Fittings.

Name _____ Title _____
Company _____
Address _____
City _____ State _____

RELATED PRODUCTS

Saran rubber tank lining—an outstanding lining where resistance to grease, many solvents, acids and other chemicals is indicated.

Saran rubber molded parts—stoppers, diaphragms, various-sized moldings for valves, instruments, etc.



INDUSTRIAL NOTES, cont. . .

subsidiary of Pfizer in the United States.

Libbey-Owens-Ford Glass Co.'s Plaskon Division—A Cincinnati branch office for coating resins headed by Henry C. Stumpe, Jr.

Heyden Chemical Corp., New York, has moved its Philadelphia branch sales office to the Lincoln-Liberty Bldg.

Kentucky Synthetic Rubber Corp. has established headquarters in Stamford, Conn.

Chemical Mfg. Co. has moved its New York offices to larger quarters at 444 Madison Ave.

E. I. du Pont de Nemours and Co., Wilmington, Del., has moved the main West Coast office of its dyes and chemicals division and rubber chemicals division to 845 East 60th St., Los Angeles.

NEW COMPANIES

Viscosa Colombiana, S. A., established by Celanese Corp. of America and Coltejer, largest cotton textile company in Colombia, to produce viscose rayon in Colombia. The company's new plant is at Medellin.

Eriez International Corp., Erie, Pa., to export and import industrial equipment, products and services.

Atomic Center, a New York technical sales organization to serve the atomic energy program with all its standard and specialized instrument and equipment needs. The first organization of its kind in the country, it already features the products of some 25 leading American, Canadian and British manufacturers of instruments for all phases of the atomic and nucleonic field.

Diamond Alkali Inter-American Corp. and **Diamond Alkali International, Inc.**, formed by Diamond Alkali Co. to handle its increasing volume of export sales. The Inter-American company will be the sales outlet in Latin America; the International company will serve all other areas of the world.



RECESSED-END FITTINGS . . . Stainless Type 304-347-316. Low cost, light weight fittings for fast, simple soldering, brazing or socket welding. Sizes from 1/2 in. thru 24 in. Full line of elbows, tees, adapters, etc. Covered in Catalog 948.



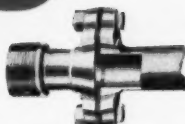
"ZEPHYRWELD"® WELDING FITTINGS . . . SS Type 304-347-316—Inconel and other SS analyses. Fabricated in O.D. Pipe and Tube Size, 1/2 in. thru 24 in.—ells, tees, adapters, etc. Covered in Catalog 748.



CLAMP-TYPE CONICAL FITTINGS . . . requires only 1 simple ferrule, assures leak-tight joints thru sanitary Teflon gaskets. Fast, simple assembly and disassembly. Full line in sizes from 1 in. thru 4 in.



SANITARY TYPE FITTINGS . . . Stainless and Tri-Alloy (Nickel Alloy) from 1 in. thru 4 in. O.D., full range of fitting types. Approved as meeting 3A Standards throughout, incorporating exclusive design features. Covered in Catalog 150-B.



CONICAL END FITTINGS . . . Stainless Type 316—Inconel and other SS analyses. Complete line, sizes from 1 in. thru 4 in. O.D. Features: Light weight—low cost—fast installation—leak tight—easily adapted to other fitting types. Covered in Catalog 848.



... for the **COMPLETE LINE*** of
LOW-COST CORROSION-RESISTANT PIPING
... in both Tube O.D. and Pipe O.D. types

Here you see five representative fitting types that go to make up the complete Tri-Clover line—all available from one source. Install these stainless steel or alloy products in your process lines and realize the advantages of increased production and lower maintenance cost. 32 years of specialized experience in solving corrosion piping problems can be yours by consulting our engineers.

Write for details, or see your nearest Jobber.

Tri-Clover®

MACHINE CO.

Kenosha, Wisconsin

TRIALLOY AND STAINLESS STEEL
SANITARY FITTINGS, VALVES,
PUMPS, TUBING, SPECIALTIES



THE Complete LINE

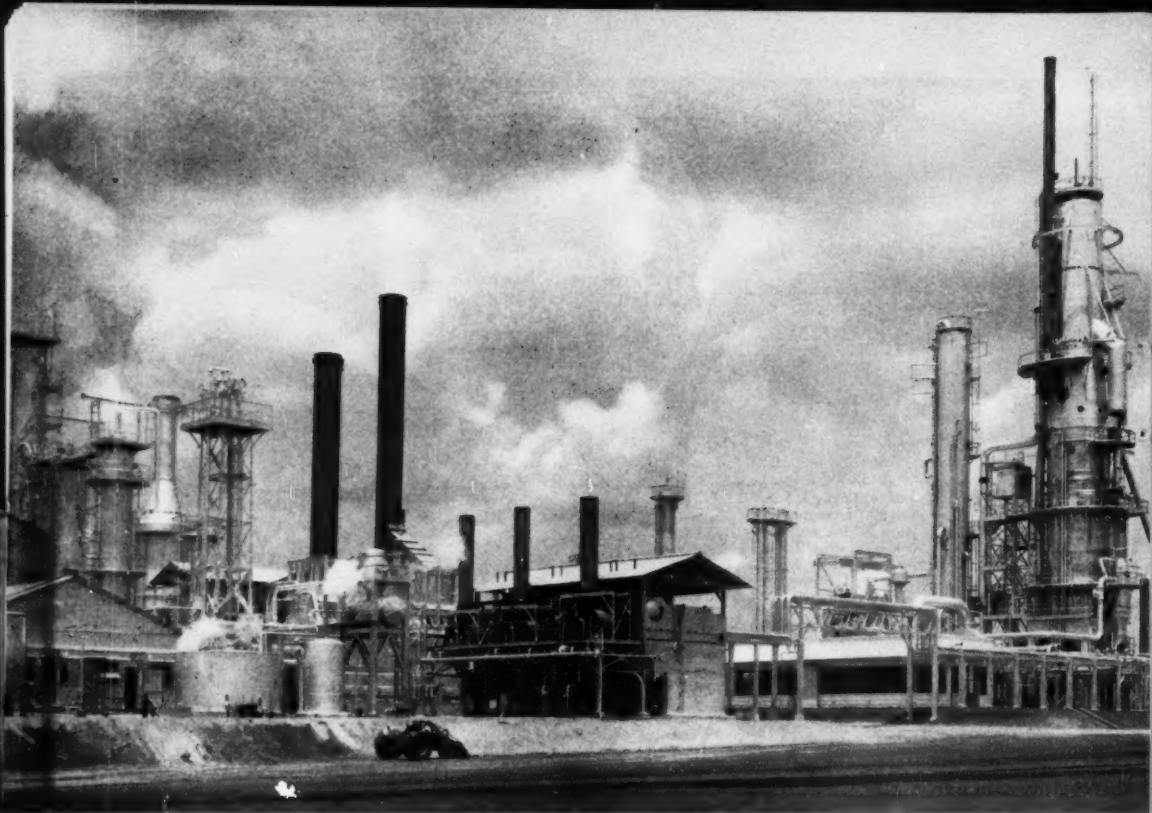
FABRICATED STAINLESS STEEL
INDUSTRIAL FITTINGS AND
INDUSTRIAL PUMPS

*ALL FROM 1 SOURCE

The **COMPLETE Tri-Clover Line** includes:

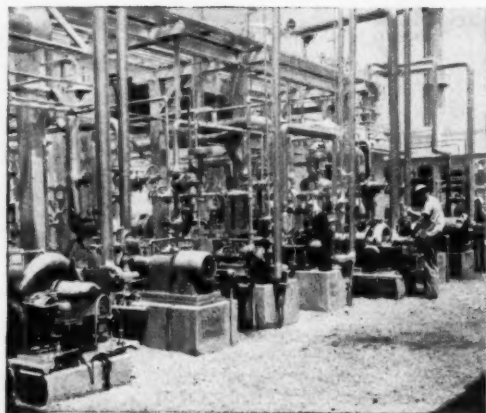
- Flared Tube Fittings (Koncentrik)
- Tube O.D. Butt Weld Fittings (Zephyrweld)
- I.P.S. O.D. Sch. 5 and 10 Butt Weld Fittings (Zephyrweld)
- I.P.S. O.D. Sch. 40 and 80 Butt Weld Fittings
- Flanged Conical End Fittings (Tube O.D.)—1" Through 4"
- Industrial Recessed End Fittings (Tube O.D.) 1" Through 10"
- Screwed and Flanged Valves (Powell)
- Special Fabricating Facilities
- 3A Standard Sanitary Fittings and Valves (Stainless Steel and Tri-Alloy)
- All-Sanitary Magnetic Full-Flow Traps
- Centrifugal Pumps—Sanitary and Industrial
- Stainless Steel Tubing and Pipe—All Sizes and Analyses

(Inventories carried in distributors' stocks strategically located throughout the United States.)

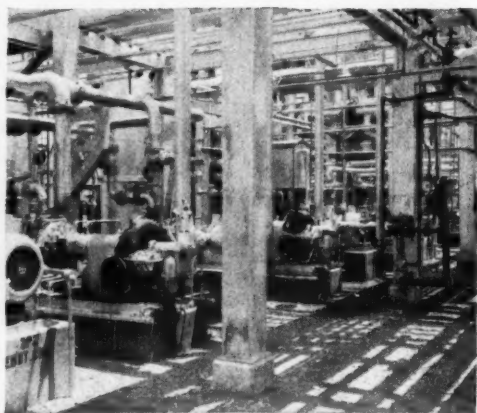


McMurrey Refining Company, Tyler, Texas, installed G-E mechanical-drive turbines throughout their plant to help assure continuous capacity output of 5000 bbls. per day.

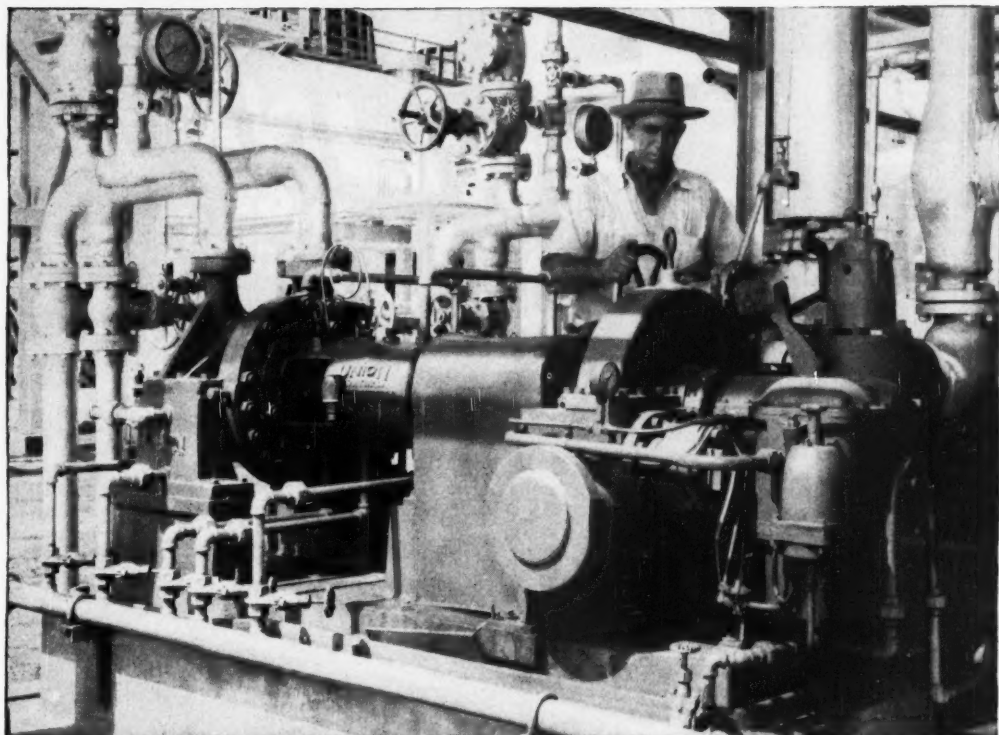
G-E Turbines Save Maintenance,



G-E turbines and motors are paired at McMurrey Refinery to utilize large steam supply efficiently. When process steam demands decrease, surplus steam is economically diverted to turbine drives. These Type DP turbines range from 8 hp to 41 hp.



Shown here is part of a row of ten General Electric Type DP turbine drives and motors, ranging from 9 hp to 48 hp. The many interchangeable parts on these turbines make stocking of spare parts an economical matter.



Maintenance personnel at the refinery have found this General Electric Type DP mechanical-drive turbine, like the many

others at the refinery, easy to maintain. This 47-hp turbine at McMurrey Refinery drives a boiler-feed water pump.

Inventory Costs at McMurrey Refinery

Installed to improve steam balance, G-E standard turbines, with many interchangeable parts, also cut inventory costs.

The McMurrey Refinery, Tyler, Texas, installed General Electric mechanical-drive turbines to help regulate steam balance. Since process steam demands range from 30% to 70% of available supply, surplus steam is economically diverted to turbine drives.

Time soon proved that General Electric turbine drives have many other advantages. Mr. Dave Hood, Mechanical Maintenance Foreman at the refinery, states, "With these turbines on the line now for over a year, we're happy to report that they are extremely easy and economical to maintain, requiring very little of our time for maintenance."

Mr. Hood also said, "Since we have quite a few different sizes and ratings of turbines here, we're particularly pleased with the great number of interchangeable parts on these turbines. It certainly cuts down our inventory problem." Interchangeability of a great majority of the replaceable parts (regardless of hp rating) is a big feature with G-E standard turbine drives, which are paired with motors throughout the refinery to help assure uninterrupted service.

Call in your G-E sales-engineer or write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." Section 252-59, General Electric Company, Schenectady 5, N. Y.

GENERAL  **ELECTRIC**

FLOWLINE^{TRADE MARK}

WELDING FITTINGS

Stainless Steels, Monel, Nickel



3000 Stock Items Made by Corrosion-Resistant Specialists

FLOWLINE Welding Fittings are made and stocked by an organization having greater experience with corrosion-resistant metals than any other fittings manufacturer. The purpose of this specialization is to make it practicable for users of corrosion-resistant piping to have the full efficiency and economy of welded construction—in design, installation, operation and maintenance.

Welded construction permits greatest freedom in designing the layout. The initial cost is usually less than for other types of installations. The system uses less space, is lighter, stronger, and can be assembled and put into service faster. It is perma-

nently leak-proof, provides best flow characteristics, has longer life, and can be changed and added to more easily and economically.

The most effective corrosion-resistant welded system can be obtained by using FLOWLINE Fittings—tees, elbows, stub ends, reducers, returns, and caps. Normally stocked at strategic points in Schedules 10, 40, and 80 (Schedule 5 also available)—sizes 1/2" through 12"—in stainless steel types 304, 316, 347; Monel and Nickel. They are handled by distributors throughout the country who are experts in corrosion-resistant piping.

WELDING FITTINGS CORP.
NEW CASTLE, PENNSYLVANIA

World's Largest Manufacturer of Stainless Welding Fittings

IMPROVING REPORTS

... Can You Shorten It?

"The Gettysburg address took 266 words, the Ten Commandments 297; but the new ruling of O.P.S. to reduce the price of cabbage required 26,911."—overheard at the 60th Annual Meeting of the American Society for Engineering Education.

ABATING AIR POLLUTION

... Power Failed

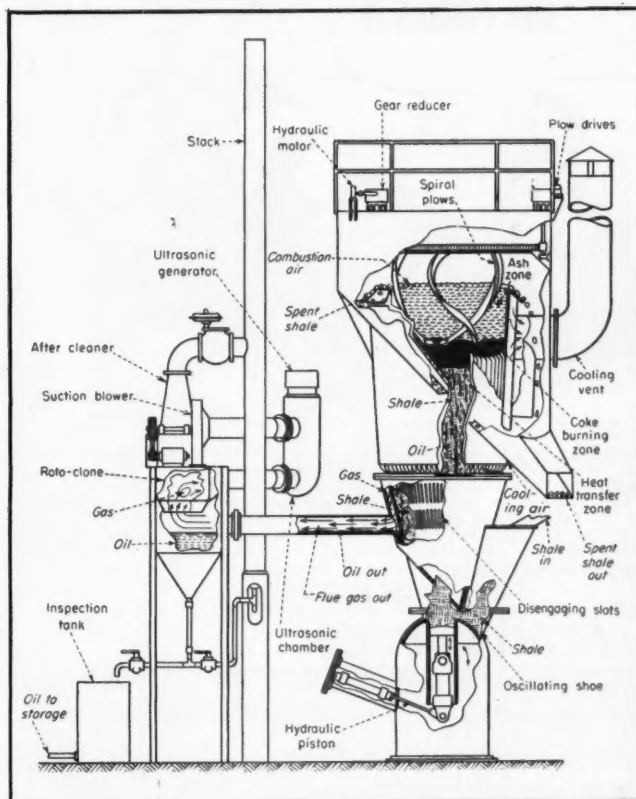
When chlorinated phenol breaks loose, as it often does in the manufacture of 2,4-D weed killer, it can create a mean pollution problem. Chlorinated phenol has a pronounced medicinal odor, and a bit of it can odorize a good-size area. Even emissions of 1 lb. per hr. is definitely objectionable.

This summer, H. C. Hosford of Du Pont's Cleveland Works, told members of the Air Pollution and Smoke Prevention Association of America at Cleveland how Du Pont licked a tough chlorinated phenol pollution problem.

The company had installed an absorption system, but chlorinated phenol still escaped from time to time. However, the system was not at fault. Whenever power failed or a pump would kick out, circulating liquid over the absorption tower was lost. "Happening unexpectedly, we just couldn't get the reaction stopped fast enough to prevent some emission from the tower," Hosford said.

We licked this by installing standby pumping facilities to pump the liquid absorbent over the tower with the pump powered by a gasoline engine. This was hooked up in such a way that it would kick on automatically when the circulation over the tower fell below a certain set point.

"Thus, whether it was a general power failure or pump failure or what have you, the instant the circulation over the tower became deficient, the standby pump took over and kept the scrubber adequately wetted until we were able to slow down and stop the reaction. . . ."



EXPERIMENTAL RETORT, prototype of Union Oil's proposed commercial retort, can handle 50 tons of shale a day. Commercial retort will process 1,000 tons daily.

Next Step: Commercial Retort For Processing Shale Oil

Union Oil Co. of California, which developed a process for retorting shale oil in 1950, has recently drawn up plans for processing shale oil on a commercial scale at its Parachute Creek, Colo., deposits. However, the output from the planned facilities would not at this time compete economically with crude oil; therefore Union will not exploit its process. It will however wait for either a petroleum shortage or a marked reduction in oil shale process costs.

At the meeting last month of the

Petroleum Division of the American Society of Mechanical Engineers held in Kansas City, Union Engineers Homer Reed and Clyde Berg outlined the company's long-range plans for retorting 20,000 tons of shale per day, the output of a typical commercial mine. The retorting plant, according to the two men, will employ a battery of underfeed retorts, each having the capacity of 1,000 tons per day of shale. It will also have a centralized gas handling system as well as hydraulic power supply equipment.



That's right, tools aren't needed to recharge an Ansul Dry Chemical Fire Extinguisher. Nor is it necessary to send the extinguisher away for recharging. After use, even the most inexperienced operator can quickly recharge an Ansul Dry Chemical Fire Extinguisher. This assures you of continuing fire protection.

Ansul Dry Chemical Fire Extinguishers are approved for Class "B" and Class "C" fires by the Underwriter's Laboratories Inc., Factory Mutual Laboratories, and the U. S. Coast Guard. Field experience has proved Ansul Extinguishers are your best protection for flammable liquid, gas and electrical fires.

SEE PAGE 298

INTRODUCING...

A NEW SERIES OF STAINLESS STEEL VALVES AND FITTINGS THAT MAINTAIN RATED INSIDE DIAMETERS AND PRESSURES

9/16" OD BY 5/16" ID . . .

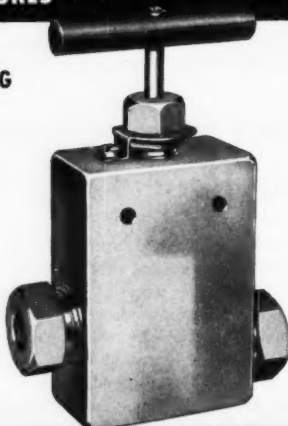
5,000 PSI . . . TEFLON PACKING

Now, for the first time, rated inside diameters and pressures of a system can be maintained through valves and fittings. For semi-works and pilot plant installations.

Valves and fittings available in type 303 stainless steel. Tubing in type 304 stainless steel. Valves and fittings in other materials on special application.

Another exclusive feature is the external aluminum bronze gland nut that assures smooth, easy operation under all working pressures.

Write _____
FOR BULLETIN 5152



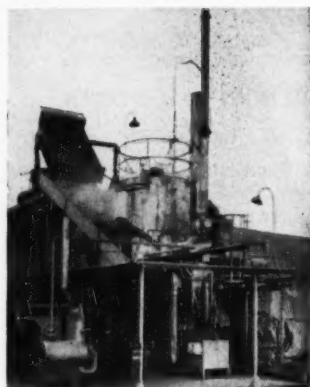
AUTOCLAVE ENGINEERS, INC.

860 EAST 19th STREET • ERIE, PENNSYLVANIA

EXPORT DEPT. • 751 BREXEL BLDG. • PHILADELPHIA 6, PA.

LABORATORY & PILOT PLANT HIGH PRESSURE EQUIPMENT

QED, cont. . .



EXPERIMENTAL RETORT receives a shale load. Preceding cuts shows details.

To cut down handling, the retorts will be located at the mouth of the mine. Crushing facilities will consist of a one-stage breaking operation to reduce the run of the mine to an aggregate maximum 4-in. particle diameter.

The retorting plant will turn out, Reed and Berg say, a shale oil of relatively constant quality with little variation due to fluctuations in operating conditions. The crude shale oil will have an exceptionally low water and ash content, averaging 0.2 and 0.003 weight percent respectively. The retorted oil and gas will be sent to a refinery site located a few miles from the mouth of the mine.

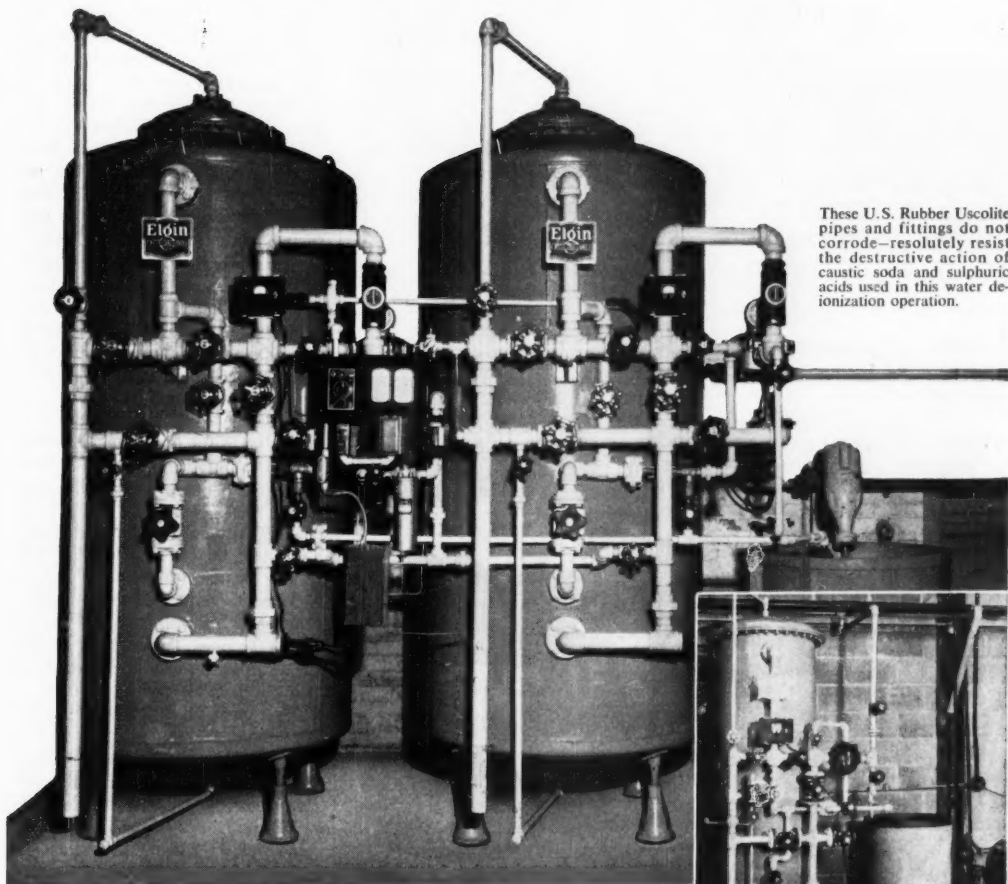
COMMERCIAL RETORT

The proposed retort, which is based on the design of the retort shown above, is equipped with four feeding mechanisms which operate in unison and discharge the shale into four separate disengaging sections which in turn are combined into a single retorting section. The gas and oil from the disengaging sections enter a common collector from which the products are discharged into a main and gas oil header handling a number of retorts.

Feeding Mechanism—The four feeding mechanisms for each retort are hydraulically operated with a common pilot valve system that actuates the four feeders to discharge and fill simultaneously. A uniform shale retort is maintained over the entire cross sectional area of the retort.

The feeding piston, is actuated by a

What does U. S. Rubber do for water-treating installations?



These U. S. Rubber Uscolite pipes and fittings do not corrode—resolutely resist the destructive action of caustic soda and sulphuric acids used in this water de-ionization operation.

"U. S." Uscolite plastic pipe and fittings form the intricate network above—integral part of a water-treating installation. Just as these water-conditioning units help cut costs in plants and home, so their Uscolite pipes effect considerable savings in time and money for their operators. That's because non-corrosive Uscolite piping handles more easily, requires less maintenance and lasts longer.

What are your piping needs? Uscolite is available in standard lengths, can be cut to size and threaded on the job. For quick action, write to address below.

Product of



Inside and outside this ultra De-Ionizer, Uscolite pipes are used. Unlike other plastic pipes, Uscolite is not brittle, does not swell, will not contaminate water as metal piping does.

Photos courtesy of Elgin Softener Corp.

UNITED STATES RUBBER COMPANY
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.



precision-made to your needs...

BENDIX-FRIEZ thermistors

Maybe your need for these temperature responsive resistors can be satisfied by a type we carry in stock. Maybe you require a specially-developed type. In either case you can depend on Bendix-Friez to provide precision-made thermistors to serve you with maximum efficiency. High standards of quality control in manufacture make Bendix-Friez Thermistors pre-eminent in their field... assure you of utmost satisfaction.

STANDARD TYPES FOR IMMEDIATE DELIVERY

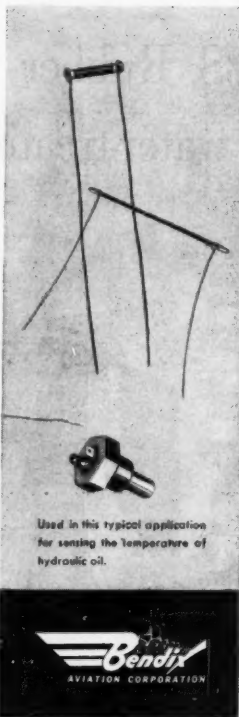
Size (inches)	@ +30°C.	@ 0°C.	@ -30°C.
.140 x .75	45.0 ohms	86 ohms	194 ohms
.040 x 1.5	12,250 ohms	26,200 ohms	65,340 ohms
.018 x 1.5	35,000 ohms	82,290 ohms	229,600 ohms

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QED, cont. . .

hydraulic cylinder mounted inside the piston. This assembly is oscillated between loading and discharge positions by a horizontal hydraulic cylinder.

A removable cover on the side provides free access to all the internals of the feeder case. The feeding cylinder can be installed through this access door as well as the shaft and bearings of the operating mechanism. The equipment can be checked for alignment and stroke before the access door is bolted into position.

Disengaging Section—The disengaging section of the 1,000 ton per day retort consists of four 70 deg. cones. These cones possess a substantial section of slots through which gas and oil are disengaged. The products of the shale-kiln discharge are collected in an annular section surrounding the slotted area. Solids that may drop through the slots fall down through the liquid seal and are reintroduced through the feeder.

Retorting Section—Fins that completely cover the heated metal surface cool the retorting section. They effectively maintain the temperature of the shale below 700 deg. F. A cowling surrounds the fins and assures a constant flow of cooling air. The cooling air rises through the fin section and is collected in an annular ring located near the top of the retorting section. Two stacks exhaust the air from this collection ring, maintain the draft for cooling air flow.

The spent shale from the retort flows from the top of the retorting bed into the ash hopper and drops from the hopper through the ash chute into the ash disposal conveyor.

Plows—During operation of the shale retort, the plow mechanism maintains uniform air distribution that breaks up clinker formations and prevents restrictions of air flow. Three large plows are employed. They extend into the retorting bed to a depth of about one-third of the retorting section. They enter the solids bed at 45 deg. and maintain a spiral pattern so as to offer minimum resistance to solids motion.

These plows are filled with metallic sodium. Convection of the metallic sodium effectively cools the tips and prevents temperatures in excess of 800 to 900 deg. F. in spite of high temperatures in the burning zone. Heat removed from the plow tips is dissi-

pated at the top of the plow tips by radiation. The plows are supported at the periphery by a ring which is restricted in its vertical and horizontal motion by a series of rollers. This ring is slowly rotated by the hydraulic mechanism.

Operation—Operation of the kiln is entirely automatic. The flow of air is controlled by an automatic flow control system. A temperature controller actuated by thermocouples located at the shell of the retort maintains the burning section.

The retorting section may be divided into three zones. In the top zone, heat exchange between incoming air and hot clinkers takes place. In the lower portion of this top zone, the carbon residue burns on the clinker, producing flue gas with a temperature near 2,000 deg. F.

This flue gas progresses into the second zone, called the retorting zone; here the oil is educted from the shale. The mixture of shale oil vapors and flue gas progresses downward into the third zone, the condensation zone, where the incoming green shale is heated and the products of condensation are cooled and condensed. In the retorting operation hydrocarbon recovery is almost 100 percent, based on weight of oil and hydrocarbons from assay of the shale.

An important consideration in the over-all retorting operation, say Reed and Berg, is the high energy quantities available from combustion of the retort gas, amounting to approximately 25 percent of the total energy available from the retorting of shale. This gas is vital to the refining step on shale oil. For example, it would take 20 percent of the crude oil output to perform the same operation.

TRANSFERRING IDEAS

... Different Language

The layman may be baffled by legal phraseology yet the lawyer finds it a boon to his work.

"That 'deferred expenses' have actually been paid ahead of time is perfectly lucid to the accountant although perhaps a trifle confusing to the outsider. And we engineers have gone further than most other groups by inventing an entire language of our own, that of engineering drawings."

—Alex W. Rathe, associate professor of management engineering, New York University.

CONTROLLED VOLUME PUMPING

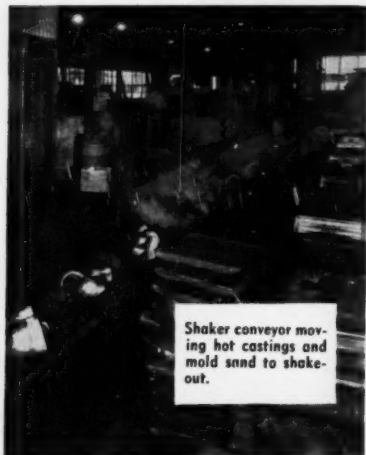


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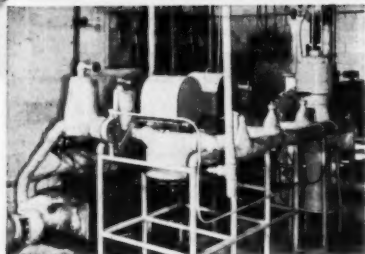
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QED, cont. . .

PURCHASING MATERIALS
 . . . *On Your Own Terms*

Purchasing men at times admit they don't know if they are doing business with a customer, or the customer is doing business with them.

They tell a story of a manufacturer who received a blueprint from a prospective customer, along with a request for quotation. After computing his costs, the manufacturer sent out his estimate, together with his conditions for doing business. Under no circumstances, he said, will the customer's conditions apply when they are contrary to his.

The customer liked the price, and sent the manufacturer his purchase order. On the back of the order, in very fine print, he listed his conditions of purchase, and said that under no circumstances will your conditions apply when they are contrary to ours.

For awhile, the manufacturer was stopped, but he soon found his answer. He sent back an acknowledgment on which is printed again his conditions of sale, and added this—That's right, under no circumstance will your conditions apply when they are contrary to ours.

(1) Do business on your own terms; (2) make sure you know your terms. This spring, Legal Director Charles S. Maddock of Hercules Powder Co. told conferees at a meeting of the National Association of Purchasing Agents at Atlantic City to make sure of these points when purchasing materials.

"If you will take the trouble to examine the contract documents of your supplier and see what you can take and what you can't . . . you will in the long run save yourself a lot of time and possibly your company a lot of money," Maddock said. "Treat each contract as an individual proposition rather than just sending out forms because the book says to do so.

"In short, negotiate your purchases, don't just issue papers. Too many purchasing men complain that they aren't given a chance to negotiate contracts and yet probably more than 50 percent of the purchase orders they issue require some negotiation on terms and conditions . . . I, of course, don't mean to imply that you will quibble over terms and conditions every time a supplier sends you his acknowledgment of order form.

New varnish filtering method boosts efficiency over 100%!



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VISKON IS STRONG WHEN WET!

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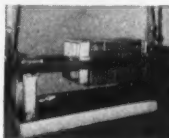
VISKON filters varnish for Lilly Varnish Company in $\frac{1}{2}$ the space with major savings in time, materials and manpower!

Here's another success story by **VISKON** nonwoven fabrics . . . how it helped solve an important filter problem of the Lilly Varnish Company, Indianapolis.

Lilly's old open filter press using canvas filters wasted up to 30 gallons of varnish each cycle. Operation was messy and hazardous. Cleaning equipment occupied valuable space, thinner created dangerous fumes.

Lilly is solving this wasteful, messy problem with modern Sparkler machines using **VISKON** nonwoven filter fabric. Now varnish waste has been cut by over 80%, cleanup takes less time. Washing machines and storage are being eliminated. Far less labor.

Investigate this new filtering method using **VISKON** nonwoven filter fabric now. Mail coupon below for additional information—today!



The old filtering method—using wasteful canvas filters.



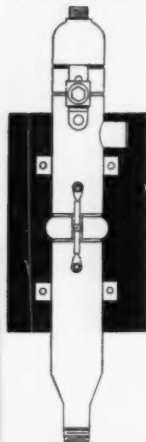
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QED, cont. . .

"Most of the time the differences in his form and yours can be resolved rather readily—but they should be resolved. Once you have done so, you have established the pattern on which you will do business in the future with that supplier . . . A lawyer's guidance will be valuable in connection with your consideration of these matters."

PREVENTING CORROSION

. . . On Aluminum Surfaces

Aluminum airplane skins, recent reports state, are still losing part or most of their paint finish before completing flight tests. Inadequate pre-treatment, paint men say, is probably to blame. Because aluminum oxidizes rapidly, especially in salt-laden air or contaminated industrial atmosphere, it is a poor base for paints. Recently, Norman P. Gentieu of American Chemical Paint Co. told readers of *Product Engineering* just how to treat aluminum surfaces.

WHAT GOOD TREATMENT IS

Simple treatment—cleaning or etching, or both—does not change the chemical composition of the surface and is, therefore, no good. In fact, instead of retarding corrosion of the unpainted aluminum, such processes may stimulate it.

Proper pre-treatment has three goals:

1. Cleansing of the surface of all traces of contamination and corrosion.
2. Protecting the metal from corrosion by forming an impervious, inert layer on the surface.
3. Providing a sure and enduring base for paint.

In general, coatings integral with the aluminum itself are far more effective than cleaning and etching for bonding paint. These coatings fall into three main categories according to their composition: crystalline phosphate coatings; oxide coatings; and the newly developed protective chemical films, such as alodine, which give even a better bond and more durable protection than the other two.

HOW IT'S DONE

Aluminum parts can be treated by immersion, or by spraying in an industrial washing machine. Actually, immersion equipment can rapidly and conveniently process small size prod-

ucts or parts. If the production volume justifies it, immersion facilities can be mechanized. For large-scale production of formed parts, or for treating coiled stock, strip or cut-to-size sheets, a five-stage power spray washer is most convenient. Essentially, the costing process consists of six easily controlled operations:

1. Cleaning the work.
2. Rinsing the cleaned aluminum surfaces.
3. Coating the work.
4. Rinsing the clean water.
5. Rinsing with warm acidulated water.
6. Drying.

IMPROVING INSTRUMENTS

... Better Thermocouples

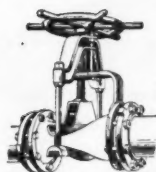
Right now, researchers at the Bureau of Standards would like to improve their temperature-measuring instruments. In recent months, they have conducted several studies that may have a fair chance for success. This summer, the bureau's temperature chief, R. E. Wilson, in a summary technical report (1677) described three such studies.

1. A search is under way for a better material to substitute for the alumel wire of a chromel-alumel thermocouple. When used under conditions encountered in exhaust gases in aircraft engines, the alumel becomes brittle and fails after a relatively short period of operation.

2. A significant advance in the measurement of extremely high temperatures was the development of an iridium-iridium-rhodium thermocouple. In preliminary studies, the new thermocouple was found to withstand both the thermal and mechanical stresses of turbo and ramjet combustion chambers.

3. Investigations have been made to determine the effect of annealing on the electromotive force of standard platinum versus platinum-rhodium thermocouples. The study included a determination of the effects of different annealing temperatures, cooling rates and atmospheres in which the thermocouples were cooled.

It was found that some of the electrical properties depend upon the rate of cooling and that not only chemical purity but also mechanical strains must be controlled for maximum uniformity.



Patented "hinged" Rubber Sleeve

Recesses molded into sides of sleeve act as "hinges" during compression, eliminating excessive strain and wear. These valves have been used successfully for many years by various industries, wherever there is a problem of transporting abrasive or corrosive pulps or liquids. Here are some of the other proved advantages of these valves:

- Long Life Under Severe Conditions
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- Positive Closure on Solids
- No Working Parts in Contact with Pulps or Liquids
- Only ONE Wearing Part
- Withstands All Chemicals Not Harmful to Rubber or Neoprene
- Sizes from 1" to 12" dia.
- Withstands pressures up to 150 psi.

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ADVISING OTHERS

... More Counsel Wanted

Were you counseled during your freshman year concerning your choice of engineering as a career? To this question, a representative group of engineers in this country answered as follows: 244, Yes; 294, No. Probably more than half of the students who elected to follow the curriculum of engineering were never questioned as to their suitability after they once entered college.

MAINTAINING PUMPS

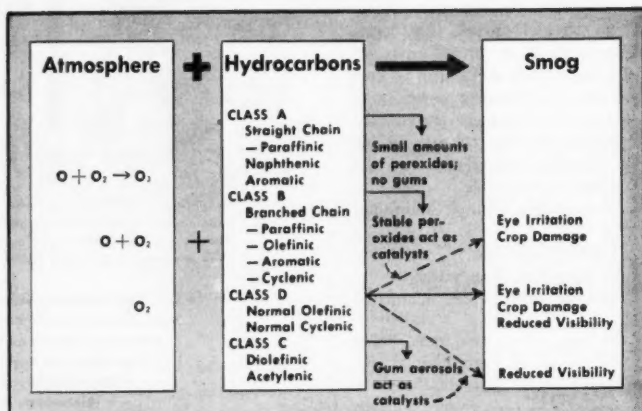
... Oil & High Vacuums

Oil seals in rotary pumps become contaminated easily. The oil may oxidize to form acids, varnishes or lacquers; process engineers may handle it carelessly during installation and contaminate it then; but most likely, the material being processed will cause contamination. In processing, dust particles become trapped in the oil film; solvents with boiling points above the operating temperature of the pump condense in it; vapors pass into the oil film; and corrosive substances slowly erode the metal parts.

As a result, contaminants build up in the vacuum oil and the pumping efficiency becomes less and less. Reason: as the volatile constituents accumulate, they increase the minimum pressure that the pump can develop in the process chamber.

What would you do with a rotary vacuum pump that held contaminated oil? This spring, Finley M. Steele of Hilliard Corp., who spoke at the French Lick (Ind.) meeting of the AICHE, offered two solutions to the problem. One, it is possible to replace the contaminated oil; however, such an operation would shut down any processing, or require the installation of standby equipment.

Two, there is a process, which uses recently available equipment, that removes the contaminants from the oil instead of replacing the contaminated oil. In this process, dirty oil taken from the vacuum system filters through fullers earth. Then the oil passes through a vaporizer, where water, gases and solvents are removed. The oil then returns to the system via a heat exchanger.



NEW SMOG THEORY is based on the atmospheric oxidation of hydrocarbons.

Abating Air Pollution

... What Causes a Smog?

"Over Los Angeles, it's certain low-molecular-weight unsaturated hydrocarbons or olefins that escape from nearby refining and petroleum marketing installations and are oxidized in the atmosphere," says Los Angeles county pollution representative.

"This is a theory—speculation—and as such just an idea that hasn't been proved. The result of studies conducted by Stanford Research Institute show that combustion products comprise a major part of total atmospheric pollution over Los Angeles," says petroleum man.

Many theories have been advanced to explain the cause of smog. In Los Angeles, blame has been leveled against sulphur dioxide, the atomic bomb, the Mexican volcano Parícutin, oil refineries and occult powers. Recently, the Los Angeles County Air Pollution Control District promulgated a new theory based on the atmospheric oxidation of hydrocarbons. The petroleum industry in the area believes there are other explanations, and has recently questioned the theory. Here is a simulated public debate, complete with moderator, in which a fictitious representative of the petroleum industry from Los Angeles and a fictitious representative of the county of Los Angeles discuss the merits of the new smog theory. Basis for this discussion are "The Policeman Is Coming," a paper by Vance N. Jenkins, Union Oil Co. of California, presented before the mid-year meeting of the American Petroleum Institute's Division of Refining, and

the Second Technical and Administrative Report on Air Pollution in Los Angeles County put out by the Air Pollution Control District, County of Los Angeles.

Petroleum Man—Well the new idea—the new theory—is considerably more complicated than the old sulphur-dioxide one. This makes it harder to prove or disprove, and I would like to warn people against believing all the propaganda they may see about it.

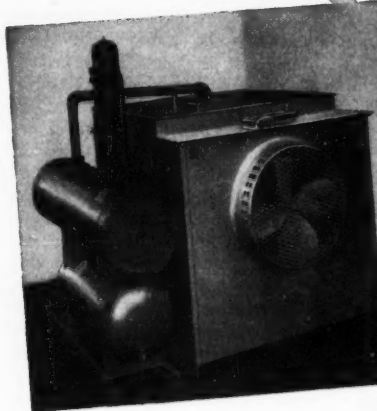
County Man—What propaganda? Our Second Technical and Administrative Report is a scientific document and released by us merely to report the results of our investigations.

Petroleum Man—Unproved speculations. The whole thing is merely an interesting guess that county officials have grabbed as a means of gaining favorable publicity for its efforts at the expense of bad publicity for the petroleum industry. (Cont.)

New

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WATER
and
CUTS
MAINTENANCE COSTS ...**

Illustration shows two views of a 35 ton Condenser Tower prior to partial disassembly for tubercle treatment.



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The Vogt Condenser Tower consists of a multipass straight tube condenser, a receiver, an oil trap, a cooling tower, and a water pump. Removable cast iron heads permit easy cleaning of the condenser tubes.

Water costs are extremely low since the cooling water is recirculated continuously and requires only a small amount of makeup to replace losses due to windage and evaporation.

Condenser Tower units are available in capacities ranging from 5 to 50 tons refrigeration. Additional information will be furnished upon request.

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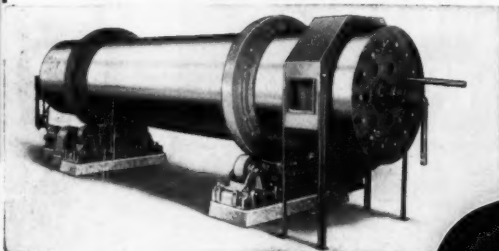
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QED, cont. . .

Moderator—I understand that the theory is not precisely the property of Los Angeles County.

County Man—That's correct. The theory is based on the work done by Dr. A. J. Haagen-Smit, professor of biochemistry at the California Institute of Technology. Dr. Haagen-Smit is a first-class scientist.

Petroleum Man—I'm sure he is.

County Man—Somewhat over two years ago Dr. Haagen-Smit became intensely interested in the crop-damaging aspects of Los Angeles smog—so interested, in fact, that he took a leave of absence from his teaching duties and devoted all of his time to developing his ideas on the cause of plant damage by smog and the nature of smog.

At this time, it was known that the Los Angeles atmosphere frequently had concentrations of ozone many times higher than other locations. Dr. Haagen-Smith theorized that this ozone, or an oxidant with the properties of ozone, reacted with the vaporized unsaturated hydrocarbons present in the atmosphere to form ozonides or peroxides. These, he concluded were responsible for the smog.

Moderator—How did he know the atmosphere contained all this ozone?

County Man—He didn't, in fact Dr. Haagen-Smit did not believe that all the required oxidant could be ozone of normal meteorological origin. It was Dr. Francis E. Blacet of the Department of Chemistry of the University of California at Los Angeles who advanced the idea that nitrogen dioxide is formed in the Los Angeles atmosphere by the oxidation of nitric oxide which, in turn, is formed in small amounts from the nitrogen and oxygen of the air during the high-temperature combustion of all ordinary fuels.

He suggested further that, after the nitrogen dioxide had formed, it was decomposed photochemically by sunlight to yield nitric oxide—from which it had been made originally—and an active oxygen atom. The regenerated nitric oxide is thus supposed to be made available for re-entering the oxidation-reduction cycle, whereas the active oxygen atom either may combine with an oxygen molecule from the air to form ozone or enter directly into oxidation reactions.

Petroleum Man—And there are

those who reject the entire idea of ozone formation by the mechanism proposed by Dr. Blacet. At atmospheric temperatures, pressures and oxygen concentrations, the oxidation of nitric oxide to nitrogen dioxide is very slow and would not be expected to go very far during the relatively short duration of a smog period.

They also do not understand why, if sunlight and nitrogen oxides are involved in the formation, the ozone is sometimes found to be quite high at night.

Moderator—Did Dr. Haagen-Smit put his theories to any tests?

County Man—Of course, he was able to produce visible mists or aerosols by the reaction of ozone and selected olefinic hydrocarbons. And he exposed plants to ultraviolet light in an atmosphere containing small amounts of nitrogen dioxide and olefins, and obtained damage similar to that produced by the kind of smogs we have here.

Petroleum Man—You might add that there are some who do not believe this experiment proves ozone was present because, under the influence of the ultraviolet light, the nitrogen dioxide may have reacted directly with the olefins to produce plant-damaging compounds.

Moderator—Would you both care to sum up.

County Man—One point may be overlooked. We claim that severe plant damage is not caused by the reaction products of ozone and just any unsaturated hydrocarbon vapor. No, the hydrocarbon had to be one of three primary straight-chain olefins—one of those having from five to seven carbon atoms with the double bond at the end, the worst offender being normal 1-hexene.

Petroleum Man—I'd like to say that the Stanford Research Institute, which has been working on the Los Angeles smog problem for four years, spending more than a million dollars for its investigation, does not believe that ozone-olefin aerosols contribute materially to the reduction in visibility during a smog period. They do believe, however, that combustion products are largely responsible. Many scientists do not agree with the county, and I don't agree. If you don't believe me, ride behind one of our buses some time, and breathe deeply.

Moderator—No thank you.

Furafil*—

anti-caking agent



Fertilizer manufacturers have found that the addition of 100 pounds of Furafil per ton of mixed goods helps prevent caking and preserves good drillability in the finished product. Several hundred thousand tons of Furafil have been used by the fertilizer industry indicating the acceptance of Furafil in this application.

When quebracho extract is ground for use as a viscosity reducing agent in oil well drilling muds, the addition of small amounts of Furafil results in an easy-flowing product which does not cake. This is of particular value during periods of high humidity.

Perhaps you have a caking problem in which Furafil can be of help. The following table gives Furafil's physical properties. Check them against your requirements.

Properties:	SCREEN ANALYSIS	FURAFIL M	FURAFIL C
	On 35 mesh	41%	29%
	On 65 mesh	25%	43%
	On 100 mesh	11%	13%
	Thru 100 mesh	23%	15%

Color: Dark brown • Bulk Density: 30-35 lbs./cu. ft.

Furafil is also used as a burn-out material with foundry sands to reduce the distortion of molds when castings are poured. A fine ground grade is sold in the plywood industry as an extender for phenolic glues used in the manufacture of Douglas Fir plywood.

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QED, cont. . .

CONDITIONING WATER

. . . Monobed Deionization

New ion exchange equipment and processes will revolutionize water purification plants. This is the opinion of Joseph Thompson, Rohm and Haas Co., who described a new system of ion exchange for demineralizing water before the recent nation meeting of the AIChE in Chicago. The process, known as monobed deionization, requires few pieces of equipment, cuts operating costs and size of water purification plants. At the present time, he says, monobed deionization has been accepted by many power engineers for conditioning water for high pressure boilers.

To remove minerals from water today, purifications plants, Thompson points out, require the services of multiple ion-exchange tanks.

ABATING POLLUTION

. . . Case History

Sanitary engineers in North Carolina face a difficult, if not unusual problem, in treating wastes from textile mills. Unlike other states, textiles in North Carolina come from a number of small mills rather than a few large ones. Consequently, waste control funds are limited, and naturally the extent of treatment at any one mill is likewise spared.

What's the best solution to the problem? "Wastes from small or medium size mills can most economically and feasibly be handled by a municipal treatment plant," says Professor of Sanitary Engineering Nelson L. Nemerow of North Carolina State College. "It should be stated that one way in which the textile dye waste problem can be solved is by joint municipal and industrial waste treatment."

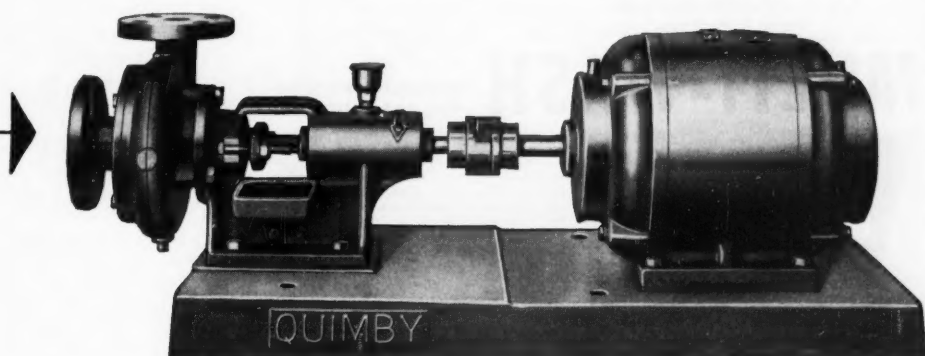
At the recent Industrial Waste Conference held at Purdue University, pollution men learned from Prof. Nemerow just how such a joint effort solved a recent waste problem in North Carolina.

Last November, a meeting—attended by representatives of the City of Salisbury, N. C., the local cotton mill, the newly formed North Caro-

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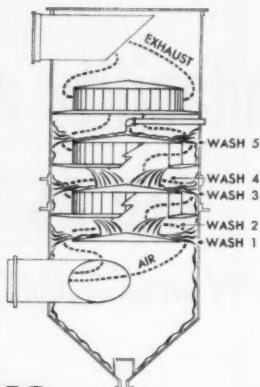
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QED, cont. . .

lina Stream Sanitation Committee, a design engineer and Prof. Nemerow—was called in Salisbury to plan the investigation and treatment of dye wastes from the local mill.

First off, a 48 hr. sampling was scheduled at the existing municipal treatment plant. During the first 24 hr., no mill wastes entered the municipal plant; during the second 24 hr., the mill waste—made up of highly objectionable sulphur dyes for the tests—flowed into the plant at peak rates.

Each hour a sample of the raw waste entering the plant was collected and analyzed. Two curves for each type of pollution characteristic—domestic and mill waste—were drawn up. Now, it was possible to determine the pollution loads the city sewage could assimilate at various times of the day.

Meanwhile, at the laboratories of North Carolina State College, sanitary engineers made a research study of a composite sewage-waste sample. They found that aluminum sulphate completely removed the visual color from the mixture and reduced the five day biochemical oxygen demand 63 percent. The dosage of alum required was 200 ppm. at the existing pH of 8.3 and 140 ppm. at a pH of 7.0. This treatment, they reported, was superior to acidification or chlorination, and better than chemical coagulation with either lime or ferrous sulphate.

After another investigation last January, the design engineer and the Sanitation Committee met to review research results and discuss the probable design of a new combined sewage-waste treatment plant. When preliminary estimates of cost are prepared, all parties will then meet. At this time, the portion of construction and operation cost of the new plant will be assigned and subsequently shared by the Salisbury mill and the city respectively.

DISTILLING FATTY ACIDS

. . . *Whale Oil Base*

Sandar Fabrikker, which is located in the small whaling town of Sandefjord in southeast Norway, put a new fatty acid plant on stream this past February. The installation, which has a feed capacity of 30 tons of whale

oil per day, was designed and built by Foster Wheeler Corp. and based on patents of Armour & Co. for the fractional distillation of fatty acids.

In a recent article in *Heat Engineering* (July, 1952), the house organ of Foster Wheeler, Francis B. White, chief chemical engineer in the industrial division of Foster Wheeler, and Arne B. Holt, U.S. representative of Sandar, jointly described the process used at Sandar's plant.

According to White and Holt, raw stock is first delivered from storage to a conical bottom tank lined with acidproof brick; there are five tanks each with a capacity of 5,300 gal. After the addition of dilute sulphuric acid to the stock, the mixture is washed with water. The water is then removed from the oil by two centrifuges.

Because Sandar's raw materials are so diversified, high pressure batch splitting is employed. Following scrubbing, the oils are fed into two 10-ton autoclaves that have a working pressure of 600 psi: here the oils are split.

After splitting, the fat water mixture is piped to stainless steel settling tanks where the sweet-water is drawn off. The fatty acids are now washed to remove the last traces of glycerine, and then dried by means of centrifuges. The sweet-water is concentrated to an 88-percent glycerine.

The split and dried fatty acids are now pumped to three storage tanks, each having a capacity of 132,000 gal. Any one of these tanks is large enough to continually furnish feed stock for a still for two weeks. From these tanks, the stock is pumped to the still area; here four fractions are produced. A usual run of the still gives: (a) odor and color fraction, (b) low molecular weight product fraction, (c) high molecular weight product and (d) residue.

If desired, one or all of the fractions may be run through the still a second time. In this way, it is possible to obtain high purity myristic acids, palmitic acids and so on. Alternately, blended fatty acid mixtures of known composition having particular properties may be produced.

The fractions from the still are received in aluminum tanks. Each tank has a capacity of 26,420 gal. and 14 such tanks constitute the tank farm for the still area. The tanks are made with bottom spherical heads and pro-

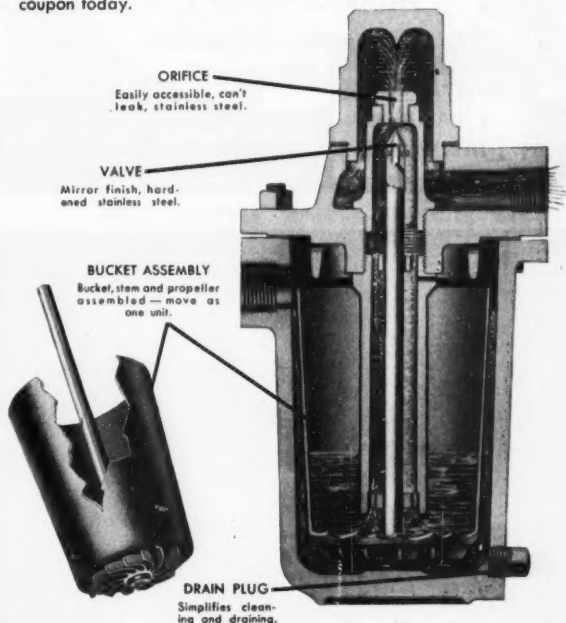
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QED, cont. . .

vided with external heating coils beneath the heads. This heating maintains the fatty acids as a liquid in the storage tanks. From storage, they are pumped to the flaker, or the block-molding installations.

PRESERVING FRUIT

. . . Possible Process

In storage rooms, most fruits give off vapors that can scald their skins and accelerate their ripening. In recent years, activated charcoal filters have been widely used to purify the air in fruit storage rooms. Another agent, ozone, has also been used but never too successfully.

In apple storage rooms, however, purification is especially difficult. The main component of apple volatiles, according to many recent reliable measurements, is ethylene, which is probably a damaging vapor. Theoretically, and here's the difficulty, activated charcoal will not adsorb ethylene; ozone should do a better job, however ozone used in suitable quantities is toxic, and cannot be tolerated in fruit storage rooms.

The problem, nevertheless, has a solution. The contaminated storage air could be drawn into a special chamber, and the ethylene reacted with ozone. But before returning the air to the storage room some means would have to be devised for decomposing or collecting excess ozone.

Not long ago, J. W. Colbert, an engineer with the Canadian National Research Council conducted an investigation to study the effectiveness of charcoal and ozone for removing low concentrations of ethylene. He hoped to work out a solution to the problem, and to collect sufficient data from laboratory measurements to permit the design of suitable decontaminating equipment. In the March issue of *Refrigerating Engineering*, he reported a successful study.

According to Colbert, charcoal will effectively remove excess ozone from the decontaminated air. Tests showed, for example, that a 0.5-in. layer of canister charcoal completely decomposed 800 ppm. ozone in air flowing through the charcoal at 10 ft. per min. In addition, the charcoal would remove heavier volatiles and reaction products along with the ozone.

Because charcoal can perform the



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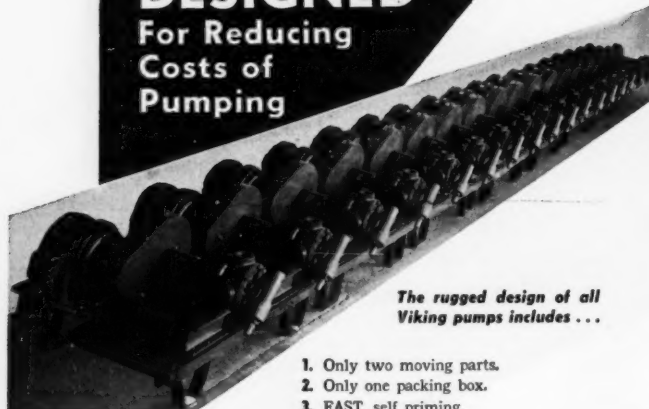
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QED, cont. . .

three operations, it would seem wise to design the charcoal bed on this basis. The efficiency of charcoal falls off rapidly after the breakdown point is exceeded; therefore the choice of conditions should be based on break-point data for all volatiles.

When this information becomes available, it could be used with the data on rate of production to determine the most economical combination of bed depth and area required to ensure continuous removal of the volatiles.

In the reaction chamber itself, catalytic surface will be needed to give the same reaction rates observed in the lab. But surface requirements should decrease when lower ozone concentrations, higher temperatures and higher humidities are used. It should be emphasized, however, that a loss of efficiency results unless the material used has a high surface to volume ratio.

DESIGNING WORK FORMS

. . . Forty Check Points

"It is not necessary to take a special course to design a good work form," says John B. Bennet of Hazeltine Electronics Corp. "Should the occasion arise where the company needs a new form, all that is required is that you have a good understanding of the problem to be solved."

Before designing a form, Bennet advises checking the 40 points he listed in the July issue of *Plant Engineering*. They are:

Ground Work: Work up some background information.

1. Define and limit the purpose of the form.

2. Avoid information on the form not related to the operation to be covered.

3. Guard against duplication of forms already in use.

4. Adapt existing forms wherever possible.

5. Decide carefully on the distribution of copies of the form.

6. Compare notes with all departments and personnel whose work would be affected by the new form.

7. Check to see how permanent the use of this form is likely to be.

8. Find out how much money can be spent on preparation and printing of the form.

9. Consult everybody who will have to use it and sell your ideas to them.
10. Prepare a procedure for the use of this form to put it into efficient operation.

Contents of Form: Now decide exactly what to put on the form.

1. Be sure to cover all recurring information related to the operation for which you design the form.

2. Assemble all information that will be needed.

3. Pick a good descriptive title for the new form.

4. Show all relevant dates, such as dates of initiation, receiving, transmittal, etc.

5. Include space for all needed signatures and approvals.

6. Provide spaces for "to" and "from" where the form is to be routed.

7. Decide how to number the form.

8. Check against forms which are being replaced to be sure you have not left out information previously covered.

9. Guard against excessive complexity.

10. Review these contents very critically when you are through.

Layout of Form: As a next step, think about a good layout.

1. Pick a form size that will fit in with the filing needs.

2. Select clear, short and appropriate headings for all spaces.

3. Determine the logical sequence for the items of information on the form.

4. Place items that should be seen first in a prominent position on the form.

5. Check this sequence against other related forms used by the company.

6. Put the serial number in a suitable spot for ready reference.

7. Decide if the form should be filled in by hand or typewritten.

8. Allow proper margins and spaces between lines.

9. Make sure all recurring information is actually included on the form.

10. Insert a form control number in line with the company's practice of numbering forms.

Now that the actual design of the form has been completed, consider the following when ordering the form:

1. Find out what kind and weight of paper to use.

2. Consider if it would pay to use colored copies and, if so, how many colors.

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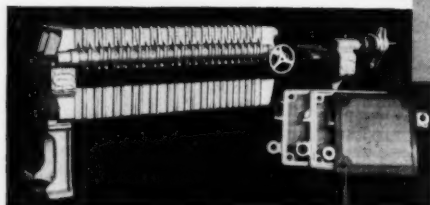


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Corner feed, washing type, steam heated, stainless steel filter press.

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QED, cont. . .

3. Determine by what process the forms should be reproduced.

4. See if it is advisable to serially number copies in advance.

5. Consider the possible use of interleaved carbon paper, perforations, etc.

6. Decide if copies of the form would be best assembled in single sheets, pads or cards.

7. Estimate the quantity requirements before placing the order.

8. Order in economic lots.

9. Locate a good storage place for the new form.

10. Decide on the manner of distribution of the form.

BUILDING UP SOILS

. . . Unhealthy Competition

Plants and soil compete for certain plant nutrients, particularly phosphates. This is the finding of Agricultural Researchers, R. L. Isaacs, Jr. and J. B. Hester of the Campbell Soup Co., who spoke at the recent national meeting of the American Chemical Society in Atlantic City. Plants absorb plant nutrients and frequently sacrifice the nutrients to a demanding soil.

If true, new investigations may have to be conducted by agricultural chemists in the light of these facts. "Perhaps much of the literature on the subject of the ready absorption of the nutrients, particularly phosphate, is based on sand culture work where there is no competition between the plant and soil," say the two researchers.

SELECTING PULLEYS

. . . Quick Facts

In a recent bulletin, the Power Transmission Council offered engineers some useful data on cast iron pulleys. These pulleys are suited for practically any service in any plant, especially in chemical plants where dampness and acid fumes may corrode other pulley types.

Sizes, to start with, run 3-in. diameter by 2-in. face to 72 in. by 40 in.; larger sizes made to order.

Cast iron pulleys usually come with crown faces or flat face, flanged, taper cone or step cone. They have solid

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VISCOSITY CONTROL is important to Fuller Brush manufacture. Special sealing compound makes their handles stay put. It's applied by expensive equipment. If the equipment is started before the compound is fluid, the automatic machinery will be severely damaged. Now a low-cost Fenwal THERMOSWITCH thermostat prevents damage by starting the motor only when viscosity is right.



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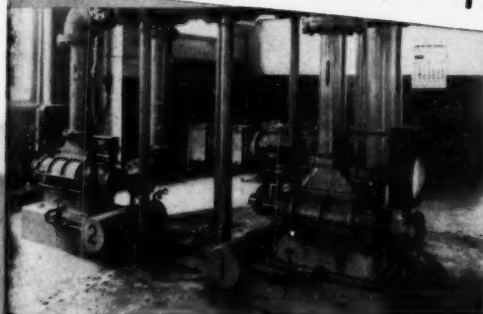
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Part of an installation of nine R-C Positive Displacement Meters in large chemical plant. Capacities from 3,000 cfh to 130,000 cfh.

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Accuracy—Not affected by pressure, wide variations in loads or other variables. Simple design, with no vanes, valves or small parts, results in maintained accuracy over long years of operation.

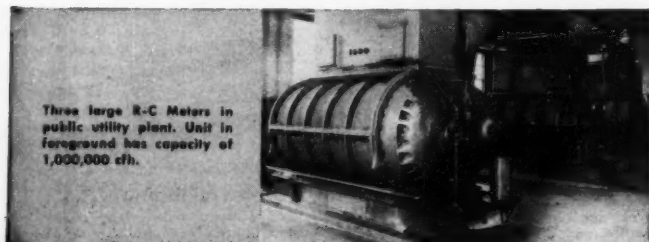
Capacity—from 4,000 cfh to 1,000,000 cfh in one unit, to meet practically any industrial metering requirements. Ample ability to absorb overloads.

Compactness—foot for foot of capacity, R-C Meters are the smallest made for industrial use. Can be "tucked away" in relatively small space without loss of valuable production area.

These values have long been proved by large and small industrial plants and public utilities. More R-C Meters are used by gas producing plants, for their own manufacturing and for commercial customers, than any other make. For details on sizes and construction, ask for Bulletin 40-B-14.

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Three large R-C Meters in public utility plant. Unit in foreground has capacity of 1,000,000 cfh.

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rim and hub, solid rim and split hub, and split rim and hub.

Center can be split or solid web, or split-arm type. Splitting arms gives added strength for rim speeds above 4,500 fpm. Split pulleys can be more easily installed on existing shafts.

Flanges may be added to outside of rim to retain belt, keep two belts separate, or aid in shifting belt from a loose pulley to a tight pulley. Flanges inside of rim help stiffen it, can be used to bolt two pulleys together.

These pulleys can be fastened to the shaft by standard square keys or with metallic bushings for compression fastening. Compression fastening is OK for most average applications. Interchangeable bushings let pulley be used on any size shaft up to its bore. Where loads are severe, better use key fastening.

Standard pulleys of cast iron are designed and built to take a stress of 65 lb. tension per in. width of medium double leather belts, or equivalent. They can also be furnished for heavy double belts with 90 lb. per in. with tension, or triple belts with 120 lb. per in. tension. Special designs go up to 210 lb. per in.

Maximum rim speeds, ft. per min., are: (1) regular iron pulleys—split or solid—3,750 fpm., (2) regular iron pulleys—specially balanced—solid or split—4,500 fpm., (3) split-arm iron pulleys—specially balanced—6,000 fpm., (4) specially designed solid iron pulleys—specially balanced—7,000 fpm. Cast iron pulleys should not run over 7,000 fpm.

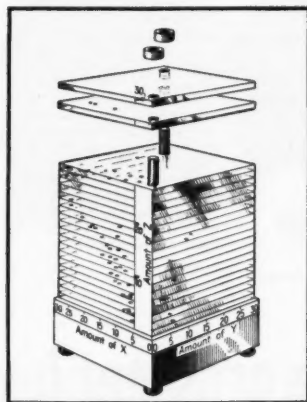
PREVENTING ACCIDENTS

... Likely and Unlikely Ones

The Association of Chemical Manufacturers have published a highway code for the chemical industry, which, a spokesman claims, should help to make British chemical works the safest in the world. There is nothing like it, he says, and the association already had requests for 40 copies from a U.S. trade association, and 50 others from Sweden.

It has taken over 20 years to write, and contains, according to the spokesman, an analysis of every likely—and some unlikely—accident that may happen in a chemical works, together with methods of prevention.

QED, cont. . .



ANALYZING DATA

. . . For Three Variables

Provided he is working with only two variables, the average research engineer usually has little difficulty plotting, and then analyzing, his experimental results. But if confronted with three or more variables in one experiment, he may try to get himself lost. For while the two dimensional graph is a simple and workable device, there is no suitable apparatus for plotting in three dimensions.

Recently, in the course of a statistical analysis of data, Physiologists R. B. Fisher and J. N. Hunt of the University of Tennessee worked up an elemental apparatus for plotting in three, as well as four, dimensions. With the device, a person without formal statistical training, can read three and four-dimensional regression equations.

The apparatus, shown above, consists of a cube of Lucite built with 20 numbered sheets—all the same thickness—locked down by two bolts and illuminated from below by a small electric bulb.

In plotting in four dimensions, two dimensions are represented by the position of points plotted in waterproof ink on the surface of the plates, the lowest of which is ruled with a grid. The third dimension is represented by the number of the plate selected, and the fourth by the color of the ink used to plot the point.

In practice, the data is first classified and then inked into the block.

When it is no longer needed, the ink spot can be cleaned off with alcohol.

When the data are plotted, a person who inspects the results through the top face of the block gets a quick appreciation of the relationship between and among variables. An examination may suggest to him the type of statistical analysis to be used.

MAINTAINING VACUUMS

. . . Lesson in Gasketing

In developing a process for making titanium, chemical engineers at National Lead Co. at South Amboy, N. J., had to work frequently with high vacuums. They generally attained and maintained vacuums in the range of 1 to 10 microns; in some cases, in the range of 0.05 to 0.01 micron. Although they learned much from current literature and manufacturers' pamphlets, they also learned much about vacuum systems from experience itself.

At the recent meeting of the AIChE at French Lick, Ind., two of the engineers who worked on the National Lead titanium project, C. Kerby Stoddard and W. E. Mooz, told of their experience in dealing with vacuum systems. In their paper, Stoddard and Mooz discussed static and dynamic vacuums, mechanical diffusion pumps, leak detection, gasketing, oil purifiers for mechanical pumps, diffusion pump fluids, valves, cold traps, vacuum welding and cleanliness of a system.

Probably the most interesting discussion of the bunch was the one on gasketing. As the authors tell it, flat gaskets were chosen initially. "At first red rubber sheeting was cut to full face gaskets for pipe flanges, liberally smeared with vacuum grease and bolts tightened until the rubber partially extruded.

"Hours of pumping failed to produce the anticipated vacuum. The procurement of a leak detector showed that the flange gaskets were leaking. About the same time someone recalled some expert advice about not using too much vacuum grease and not compressing a gasket until no resiliency remained in the rubber. Observation of these precautions and conversion to unfilled, neoprene rubber produced the proper vacuum. However, constant vigilance was re-

quired to prevent the operators from tightening the bolts until the gasket extruded and the joint leaked.

"The conversion of gasketing to total use of "O" ring gaskets completely eliminated gasketing difficulties. All flanges were cut off the pipes and welded back on after machining square sectioned grooves in one face to a depth allowing a 25 percent compression of the "O" ring gasket. The face inside the groove was machined a few thousandths of an inch below the outer flange face to permit the escape of gas trapped in the groove on the vacuum side of the "O" ring. In some cases, this was accomplished by radial slots.

"O" ring gaskets are available in various formulations of rubber and neoprene as well as silastic, in diameters up to 16 in. Generally 60 durometer neoprene was specified although silastic was used on occasion for cold traps where it was suspected that the neoprene cooled to a point where it no longer had sufficient resiliency.

"For diameters greater than 16 in., "O" rings can be made up from $\frac{3}{8}$ in. and $\frac{1}{2}$ in. diameter rubber or neoprene stock known in the trade as "rope". Vulcanized joints are superior to cemented ones. "O" ring gaskets, made in this manner with less than one percent vacuum failure, up to 42 in. in diameter have been used.

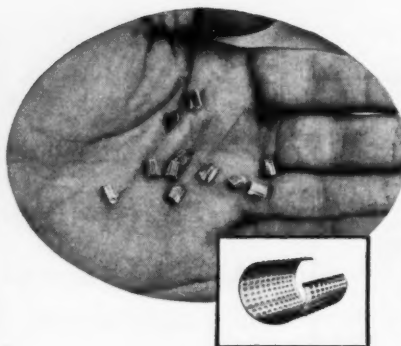
"The installation of the "O" rings in the grooves is a simple matter. If the larger diameter gaskets do not rest evenly in the groove, the simple precaution of storing them in a warm room or next to a radiator will make them limp enough to lie uniformly in the groove and save considerable time of assembly.

"Vertical joints can be made up with the "O" ring slightly undersized so that it is snapped into the groove and holds itself in place. Bolts are drawn up tight and used only in every other hole or less if feasible. Since the flange faces match metal to metal, over-compression of the gaskets is impossible and operation is facilitated. The gaskets should be coated only lightly with vacuum grease which is wiped off after applying. This leaves just the right amount of lubrication.

"Gaskets that have taken on a permanent set can be frequently reclaimed by soaking them in carbon tetrachloride and steaming them out. This cannot be done, however, if the rubber shows any signs of cracking".



LARGE ECONOMY SIZE. This 10-foot dished head, spun of Inconel-Clad Steel, is used in equipment for tall oil distillation. Costs less than a solid Inconel head, yet provides all its advantages. Circular plates of Clad Steel for heads are produced in diameters up to 162", and even larger by special rolling arrangements with Lukens Steel Co., owners of the world's widest plate mill.



MIGHTY MIDGETS. In distinct contrast to the large dished head at the left, is this tiny protruded metal tower packing. Now widely used in industrial laboratories, the packing is reported more efficient and less costly per theoretical plate than other metal packing. Formed from thin nickel strip, and containing 1,024 perforations per square inch, it offers the additional advantage of requiring no preflowing. Corners are bent inward to prevent nesting.

Plate or Sheet?..

CONDENSED REFERENCE CHART OF SIZES

Plate	Alloy	Thickness	Width	Length
	Hot Rolled:			
	Monel	3/16" — 2"	10" — 130"	up to 360" (*2)
	"A" Nickel	3/16" — 2"	10" — 130"	up to 360" (*2)
	Low Carbon Nickel	3/16" — 2"	10" — 130"	up to 360" (*2)
	(*1) and (*2)			
	Inconel	3/16" — 2"	10" — 130"	up to 360" (*2)
	Circle limitations:			
	(all metals)		up to 140" (*4)	
	Lukens Clad Steel (*3):			
	Nickel-Clad	3/16" — 2"	48" — 178"	up to 480"
	Circle limitation:		up to 178" (*4)	
	Inconel-Clad	3/16" — 2"	48" — 162"	up to 480"
	Monel-Clad	3/16" — 2"	48" — 162"	up to 480"
	Circle limitations:		up to 162" (*4)	
Sheet	Cold Rolled:	Thickness	Width	Length
	Monel	0.018" — 0.250"	up to 60"	up to 178" (*4)
	"A" Nickel	0.018" — 0.250"	up to 60"	up to 178" (*4)
	Low Carbon Nickel	0.018" — 0.250"	up to 60"	up to 178" (*4)
	Inconel	0.018" — 0.250"	up to 60"	up to 144" (*4)
	Circles: (*5)		up to 60"	
	* Notes ...			
	1. Not all thicknesses are available in all widths or lengths.			
	2. Widths, lengths, and heavier thicknesses beyond limits shown can in some cases be secured. All plate over 1 1/4" thick must be machined to size.			
	3. In addition to the availability of wide plates of Lukens Clad Steels, flanged and dished heads are also obtainable in sizes to over 18 ft.			
	4. In some gauges.			
	5. Produced as sheared or machined to size. Half circles are also produced.			

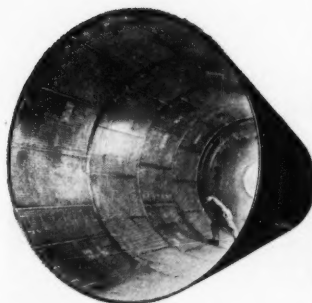
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 Edmonton, Alberta—Wilkinson Company, Ltd.
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 New Orleans 12—Metal Goods Corporation
 New York 14—Whitehead Metal Products Co., Inc.
 Philadelphia 40—Whitehead Metal Products Co., Inc.

Pittsburgh 33—Williams and Company, Inc.
 Portland 12, Ore.—Eagle Metals Company
 St. Louis 10—Steel Sales Corporation
 Salt Lake City 4—Pacific Metals Company, Ltd.
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 San Francisco 10—Pacific Metals Company, Ltd.
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PROTECTION FOR STEEL. This is the completely Monel-lined top section of a large fractionating tower. In use by one of the country's largest oil refiners, it provides excellent resistance to corrosion by hydrogen sulfide and the small amounts of hydrochloric acid usually present in the low temperature sections of distillation equipment. The lining shown here is light gauge Monel sheet applied to steel plate by spot welding on close centers prior to forming to shape.

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Go ahead! Write your own ticket. From thin strip to heavy plate, you'll find an Inco Nickel Alloy that meets your specifications.

Corrosion-resisting? Of course! Every single one. Strong, hard and tough, too. And highly resistant to erosion, abrasion and wear.

They're all readily fabricated. Can be cut, formed, forged, machined and welded. Joining processes, by the way, are similar to those used for steel, and include fusion welding, resistance welding, silver brazing, and soft soldering.

On this page, note how several well-known Nickel Alloys have been used. They provide longer service life. They protect product purity. They reduce maintenance problems. They cut replacement costs.

And see their range of usefulness — from tiny tower packing to a 10-foot dished head!

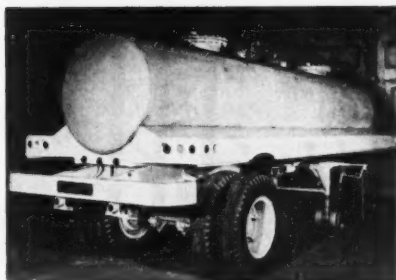
Whatever properties you want in a metal, you'll probably find in one of the Inco Nickel Alloys. Remember, though, that these metals are now on extended delivery because of defense needs. So please order well in advance of your work schedule, and include NPA rating and complete end-use information.

Also — consult your nearest Distributor of Inco Products for information and assistance. Ask him to send you — now — one or more of the important Technical Bulletins mentioned below. There's no charge, naturally. THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N. Y.



Nickel Alloys

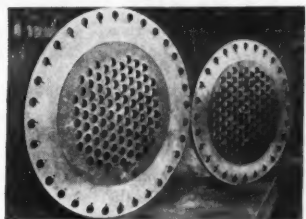
MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • NICKEL
LOW CARBON NICKEL • DURANICKEL® • INCONEL®
INCONEL "X"® • INCOLOY • NIMONICS®



NON-CONTAMINATING. Custom-built tank trailer with 2-compartment nickel tank transports pure benzyl chloride, ready for use on arrival. With the black iron containers previously used, an inhibitor had to be added to prevent corrosion and iron contamination. Since the inhibitor had to be removed, the new trailer — in addition to protecting product purity — has eliminated two unnecessary processing steps.



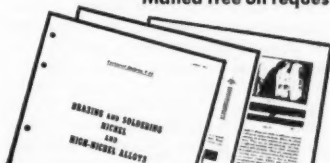
READILY FORMED. Here's a special 4-inch funnel used for filling fragmentation bombs with TNT. Made of Monel for resistance to corrosion and sparking, it illustrates the deep drawing and spinning properties of this INCO nickel alloy.



WELDABLE TO STEEL. Monel tube sheets like these are not only compatible with copper-nickel alloy tubing, but they can also be welded to steel. Both were made from metal circles, thus saving work, time and money.

A Complete Library!

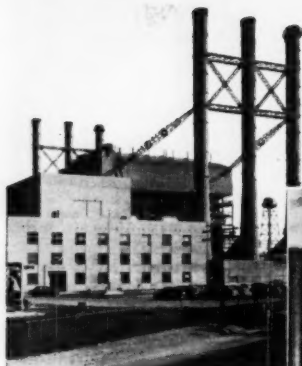
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T-2 — "Fusion Welding of Nickel and High-Nickel Alloys"

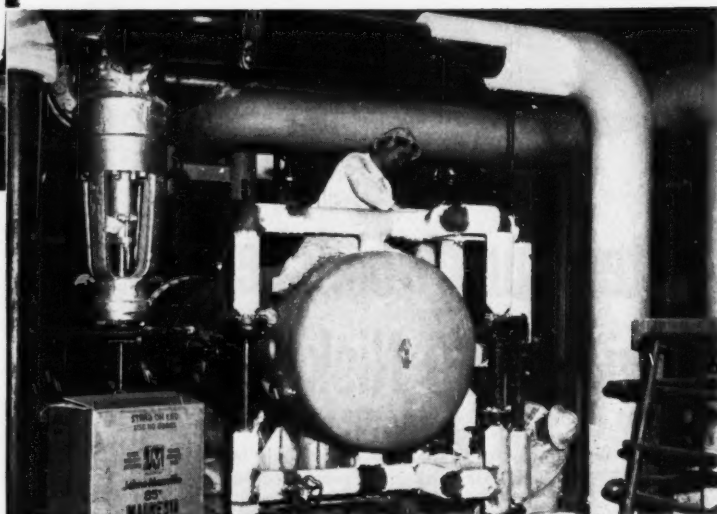
T-33 — "Resistance Welding of Nickel and High-Nickel Alloys"

T-34 — "Brazing and Soldering Nickel and High-Nickel Alloys"



(Top) Moss Landing, California steam plant of the Pacific Gas and Electric Company, designed by Stone and Webster Engineering Corporation, under the supervision of the P. G. and E. Engineering Dept.

At the new Moss Landing generating plant



(Right) Skilled applicators of an outstanding J-M Insulation Contractor, Western Asbestos Company of San Francisco, applying J-M 85% Magnesia to pipelines during construction of the Moss Landing plant.

P. G. and E. INSULATES WITH SUPEREX-85% MAGNESIA TO LOWER POWER PRODUCTION COSTS

When Pacific Gas and Electric Company invested \$80,000,000 in its new 771,000-horsepower electric generating giant at Moss Landing, California...the insulation, like all other materials, had to meet rigid specifications. *For this important project, Johns-Manville Superex-85% Magnesia double-layer insulation was used on superheated steam pipes.*

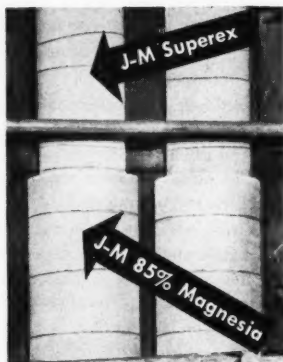
Superex Combination Insulation consists of Superex*, a J-M insulation for temperatures to 1900F, and J-M 85% Magnesia. It was installed at the Moss Landing plant for maximum thermal efficiency and long trouble-free service. This double-layer construction, proved in over a quarter-century of outstanding on-the-job performance, utilizes the higher heat resistance of Superex next to the hot surface—the greater insulation value of J-M 85% Magnesia for the outer layer. It eliminates through joints, protects the jacket against scorching and

is unharmed by expansion encountered in pipes carrying superheated steam.

J-M 85% Magnesia is the leading insulation for temperatures to 600F. It will not distort regardless of its length of service. It fits snug, stays tight. Heat savings, therefore, remain constant for the life of the equipment on which it is applied.

Whatever the insulation—it must be properly engineered and installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced J-M Insulation Engineers and J-M Insulation Contractors. These men stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings.

For further information, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.



Double-Layer Superex-85% Magnesia Insulation was used on superheated piping at the P. G. and E. Moss Landing plant.

*Reg. U.S. Pat. Off.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

Chemical Engineers' Bookshelf

Edited by Lester B. Pope

Consequences

ATOMIC POWER. By Vincent H. Whitney and Walter Whitney. Blakiston, Philadelphia. 235 pages. \$4.75

Reviewed by B. K. McKee

"Atomic Power," by Drs. Whitney and Isard, is an analysis of the economic problems involved in peacetime applications of atomic energy. Dr. Vincent H. Whitney is chairman of the department of sociology at Brown University, and Dr. Walter Isard is a lecturer in economics at Harvard University. This study is timely and important. The authors do not just state opinions but analyze the economic factors underlying any large-scale use of atomic power. They admit that they lack complete data as to the cost of atomic power and that their initial effort may soon be outdated.

Nuclear energy cannot be used directly as a source of commercial power. The heat liberated in the atomic reaction must be converted into electric power before it can be used. The nuclear power plant would resemble the present-day coal-steam electric power plant except that uranium or other fissionable material would replace the coal as a fuel.

The estimates of the amount of fissionable material available indicate that this material constitutes a significant, large reserve of power. After comparing the probable costs of atomic power with the cost of conventional power, the authors make the statement that even with optimistic direct-cost assumptions for atomic power, it seems probable that atomic plants in many locations will have difficulty competing with modern, efficient steam stations. They believe that the future of atomic power depends upon its ability to compete in cost with alternative sources of power. Their factual analysis is refreshing in contrast to the many wild unsupported predictions made as to the irresistible changes to be brought about by atomic power.

In following chapters they write about the possible effect of atomic power on the location of industry and conclude that any wholesale relocation of industry is unlikely. They

also doubt that any rapid, general, and marked increase in standards of living of the various peoples of the world, and especially of those whose standard is the lowest, will result from the advent of atomic power.

The book's theme is that the consequences of peacetime applications of atomic power will be less earth-shaking than many have predicted. The book ends with the modest remark that final answers, if such there be, lie in the future.

Welcome Monograph

PHOSPHORIC ACID, PHOSPHATES AND PHOSPHATIC FERTILIZERS. Second Edition. By William H. Waggaman. Reinhold Publishing Corp., New York. 683 pages. \$15.

Practically everyone who has had close contact with the phosphorus and phosphate fertilizers fields is familiar with the first edition of this monograph. It was published in 1927, has long since been out of date.

That situation has now been corrected. For Waggaman, one of the pioneers in the phosphate industry of this country and now with the Bureau of Mines, has revised and expanded his earlier work. He has been helped in this job by close to a dozen authorities in the field, each writing one or more chapters.

This is a reference book. It starts with history and ends with an extensive listing of patents. In between are chapters that cover just about every phase of the field: Phosphoric acid in animal and plant life, phosphate rock, elemental phosphorus and how it's made, phosphoric acid processes and economics, superphosphate and triple superphosphate, ammonium phosphates and other phosphatic fertilizers, complete fertilizers and their preparation.

Then, too, there are chapters on phosphate leavening agents, water-softening and cleansing products, esters of phosphoric and their industrial uses, phosphating of metals, how phosphates are used in the sugar industry, phosphates in flame-resistant products, analytical methods—and the

inevitable final chapter on "miscellaneous uses."

Waggaman's book probably won't satisfy the production man: It doesn't have that much detail on the latest industrial practice. It won't fill the whole bill for the engineer, for it doesn't go heavily into design and engineering features of equipment or processes.

For similar reasons, it won't become "the bible" of the specialist in chemical research, technical service, market research, economic analyses, product development, analytical methods or what have you.

But it will serve all of them—engineer, researcher, market man—as a comprehensive and reliable general reference to the entire field of chemical and fertilizer phosphates. It is a monograph that fills a need.—JRC.

The Nation's Workers

MANPOWER RESOURCES AND UTILIZATION. By A. J. Jaffe and Charles D. Stewart. John Wiley & Sons, New York. 532 pages. \$6.50.

Personnel managers, directors of industrial relations, labor leaders and top management will be interested in this scholarly and somewhat historical study of the U. S. labor force.

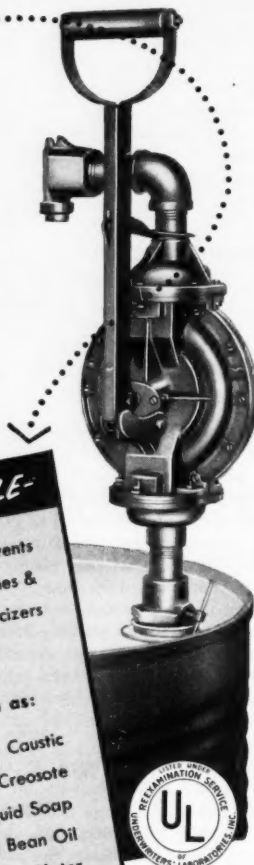
The authors, Jaffe, Assistant Director, Population Division, Bureau of Applied Social Research at Columbia University, and Stewart, Assistant Commissioner for Program Planning of the Bureau of Labor Statistics, attempt a complete analysis of the U. S. labor force:

- What it is—the totality of workers, whether employed or unemployed. The authors have tried to tell how many of these people we now have, what their personal characteristics are, what work they do, what goods or services they produce. The authors have also tried to answer such questions as why some people do not work, remaining at home, attending school or otherwise spending their time without working for pay or profit.

- The authors have also analyzed the forces that shaped U. S. labor in

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BOOKSHELF, cont. . .

the past—especially the socio-economic forces. And in the same light they have looked into the forces that are molding labor today.

• They have made a study of the relation of labor to other aspects of our society and to the working force the rest of the world.

The book is divided into three parts:

Part one defines the nature of the working force about which statistics are being collected and it explains why the definition now used by the U.S. has been chosen.

Part two gives a statistical description of the American working force, past and present.

Part three presents the available data on the relationship between the working force and the technological, demographic and social factors of society. This section also includes data from other nations.—RVR

An Exhaustive Monograph

THIOPHENE AND ITS DERIVATIVES. By Howard D. Hartough. Interscience Publishers, New York. 533 pages. \$16.50.

Reviewed by S. Archer

Weissberger's series on the chemistry of heterocyclic compounds has been joined by this exhaustive monograph. And it is by far the most complete discussion of the chemistry of thiophene and its derivatives to appear to date. Sample section headings are, The Nitro and Aminothiophenes, Carboxy Derivatives of Thiophenes, Sulfur Derivatives of Thiophene, etc. In all, the 514 pages of text are divided into 16 such sections. There are many tables listing the physical properties of thiophene derivatives. In addition, there is an appendix which contains laboratory directions for preparing some key derivatives of thiophene. Dr. Hartough was fortunate to have F. F. Blicke write a review of the biologically active thiophene compounds. F. P. Hochgesang contributed a chapter on the molecular structure and spectroscopic properties of thiophene and its derivatives. This chapter includes many infrared and ultraviolet absorption spectra as well as numerous tables of mass spectrographic data.

The author is disturbed by statements in organic chemistry texts



G-E Jet Engine Generating Plant owned by Public Service Company of Oklahoma. Roof and sides covered with "Century" Asbestos Corrugated. TOP-SIDE Fasteners used throughout.

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The economy you enjoy when you build with "Century" Asbestos Corrugated is both widespread and considerable. You save on labor costs because workmen can easily and quickly cut, fit, drill, and handle these large strong sheets with ordinary tools. If you elect to use TOP-SIDE* Fasteners, you make an extra saving in both time and money. These ingenious fasteners are installed with a minimum of labor. Scaffolding is not required—either for the roofing, or for the siding.

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It is a superior building material as hundreds of companies have found out. If you are planning new construction or modernization of existing structures, be sure you investigate the outstanding economy offered by "Century" Asbestos Corrugated. We'll gladly send you complete information on request.

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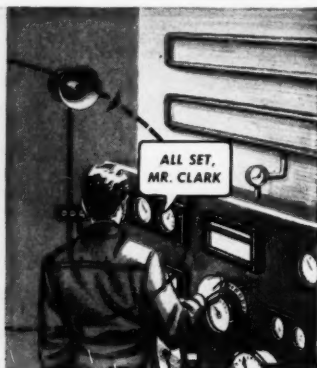
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BOOKSHELF, CONT. . .

which claim that thiophene chemistry is similar to benzene chemistry or that thiophene is more reactive or "super-aromatic." Dr. Hartough feels that "— the chemistry of thiophene and benzene is to be compared about as closely as a zoologist would compare the tortoise and the boa constrictor; they are in the same class but of widely different species." It is doubtful that the author really believes this assertion. Statements such as "reactions involving the nitrogen of the aminothiophenes are somewhat like those of aniline" (p. 234); "in general, the thiophene aldehydes undergo the usual reaction of their benzene isologs (p. 312)"; "in general, the ketones of thiophene and their derivatives resemble their benzene isologs closely in odor, boiling point, melting point, etc." (p. 339).

There are few reactions of thiophene and its derivatives, (save those involving the sulphur atom) mentioned in this book which do not find counterparts in the benzene series. Perhaps one reason that thiophene compounds have been rather disappointing commercially is that a great deal of research in this field has been directed to demonstrate the similarity between benzene and thiophene compounds rather than to exploit the differences.

Very little discussion of the theoretical aspects of thiophene chemistry is presented. The very interesting observation that ethylene and propylene alkylate thiophene poorly or not at all while isobutylene reacts rapidly is dismissed with the statement, "it might be that alkylation of thiophene with olefins involves a copolymerization mechanisms with a subsequent rearrangement to the mixed alkylation products." No evidence for this conjecture is presented. Regarding the acylation of thiophene it was stated that "— it will be more clearly indicated that the mechanism for the acylation of thiophene unsubstituted in the 2- or 5- position does not correspond in general to the mechanism for the acylation of benzenoid hydrocarbons proposed by Groggins, Nagel and Stirtin. Indeed acylation proceeds in a manner similar to alkylation."

Actually in his paper Groggins (1934) proposed no mechanism for the Friedel-Crafts reaction. He confirmed the fact that a slight excess

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SUMMIT, N. J.

BOOKSHELF, cont. . .

above molar amounts of catalyst is required to promote acylations. It would seem more appropriate to cite some of the more recent work on the Friedel-Crafts reaction. It is fairly well established now that the reactive intermediates in the alkylation and acylation reactions are very similar. The positive fragment in the former is a carbonium ion, RC^+ , and in the latter an acylium ion RCO^+ .

There were some minor points

which seemed to be errors in judgment. For example, the author claims his own preparation of vinylthiophene to be the best. To this the reviewer this assertion is open to question. It is desirable to point out certain unsolved problems in a book of this kind but it is of questionable value to outline in some detail a possible (but to the reviewer, improbable) solution.

The typography and format are excellent. Except for the weaknesses noted above the monograph can be recommended to all organic chemists.

Recent Books & Pamphlets

Subject	Summary	How to Order
Liquid Fuels	Two part report on the entire synthetic liquid fuels program. Comprehensive coverage of all aspects of what is being done by industry and government. Profuse use of illustrations and tabular material. Part I, 83 p.; part II, 86 p.	Annual Report of the Secretary of the Interior for 1951. Part I, RI 4865; Part II, RI 4866. Bureau Of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa. Gratis.
Instruments	All phases of displacement meters are covered from fundamental principles of gas measurement to proving, maintenance and repair of tinned steelcase and ironcase meters. Pictures, diagrams, charts, tables and other data. 275 pages.	"Displacement Gas Meters." By John C. Diehl. American Meter Co., 60 East 42nd St., New York, N. Y. \$4.50.
Lime	Past lime production of Oregon, Washington and Idaho, current producers and those from outside the area shipping to this market are discussed. The area's present and possible consuming industries are enumerated with notes on their processes and lime requirements. 22 pages.	Resource Report No. 6. By Leslie C. Richards and A. O. Bartell. Raw Materials Survey, 701 Woodlark Bldg., Portland 5, Ore. Gratis.
Cottonseed Oil	Analysis of operating practices of the cottonseed oil milling industry as based on Bureau of the Census data. An attempt is made to relate variations in practices to variations in costs and other economic factors. 35 pages.	Agriculture Information Bulletin No. 79. Supt. of Documents, Washington 25, D. C. 25 cents.
Mines	Latest available information on close to 7,000 active mining companies in the Western Hemisphere that produce precious, semi-precious and non-ferrous metals. Includes a comprehensive buyer's guide to manufacturers of mining equipment and supplies. 772 pages.	"Mines Register." Atlas Publishing Co., 425 West 25th St., New York 1, N. Y. \$25.
Metallurgy	New monthly periodical devoted to abstracts of current literature on metals of unusual current and potential interest to research and development.	"Cramer Metals Abstracts." John Cramer Library, 86 East Randolph St., Chicago 1, Ill. Annual subscription rate: \$50.
Lead	Manufacture, applications and properties of lead, lead alloys and lead compounds. Sufficiently technical to be of practical value to the engineer in industry. Drawings and photographs. Cloth bound. 230 pages.	"Lead in Modern Industry." Lead Industries Assn., 420 Lexington Ave., New York 17, N. Y. \$1.50.

(Continued)



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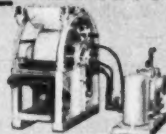
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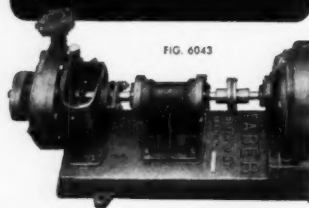


FIG. 6043

**PUMP SHOWN
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apparatus from which liquids are to be removed under vacuum. • Large chamber completely surrounds the stuffing box and seals perfectly against vacuum. • The water chamber surrounding the stuffing box can also be used as a drip chamber when pumping fluids from atmospheric pressure. • Sealed, double ball bearing shaft support is another feature of this Taber single suction centrifugal pump. • Built of any obtainable metal or alloy found suitable by customer. • Please use your business stationery when writing for BULLETIN CL-339.

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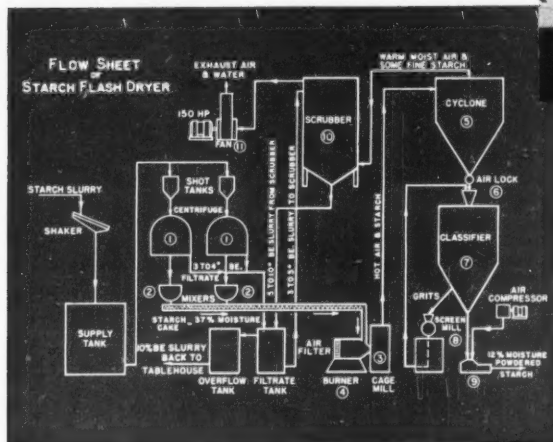
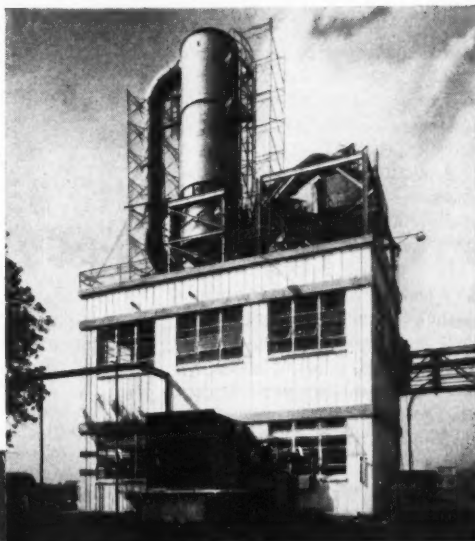
**BULLETIN
CL-339
AVAILABLE**

RECENT BOOKS & PAMPHLETS, cont. . .

Subject	Summary	How to Order
Paper Coating	Manufacturers and users familiar with the properties of protein and synthetic adhesives describe their use in the coating of paper. Blend of theory and practice. 187 pages.	"Protein and Synthetic Adhesives for Paper Coating." Monograph Series—No. 9. Technical Assn. of the Pulp and Paper Industry, 122 East 42nd St., New York, N. Y.
Texas Chemical Market	Report on a survey to determine the dollar volume of chemicals and allied products Texas firms and agencies purchased out-of-state in 1951. 8 pages.	Research Report 37. By James R. Bradley, W. B. Langford and L. S. Paine. Texas Engineering Experiment Station, College Station, Tex. Gratis.
Phosphorus	Summary of the results obtained from developmental work on the production of elemental phosphorus by the electric furnace method. Design and operation of the furnaces. Numerous equipment and flow diagrams, photographs. 312 pages.	Chemical Engineering Report No. 3. Tennessee Valley Authority, Knoxville, Tenn. \$2.
Uranium and Thorium	Glossary of uranium and thorium bearing minerals intended as a guide to the nomenclature of these minerals. Lists minerals and their chemical formulas together with information as to series relationships.	Geological Survey Circular 194. By Judith W. Frondell and Michael Fleischer. Director, Geological Survey, Washington 25, D. C. Gratis.
Defense Production	A directory of defense production facilities in Rhode Island. An alphabetical listing of products and services, basic data on each firm (over 1,600) listed.	Rhode Island Development Council, State House, Providence, R. I.
Equipment	Report on a mission to study the equipment of the chemical industry in the U. S., organized by the Technical Assistance branch of the ERP. Three parts: general discussion of the working methods of the U. S. chemical industry; process instrumentation; itinerary of the mission.	Columbia University Press, 2960 Broadway, New York 27, N. Y. \$6.
Materials Handling	The need and the equipment for a system of methods and equipment which ties together productive and nonproductive units. Manufacturers of the materials handling equipment. 19 pages.	Material Handling Institute, 811 Clark Bldg., Pittsburgh 22, Pa.
Insect Damage	An introductory study of the economics of pests and diseases in agriculture. Shows man's loss of crops throughout the world and how this affects food supply and social problems.	"Untaken Harvest." By George Ordish, Constable & Co., Ltd., London. 171 pages. 15 s. net.
Fluorspar	Background facts bearing on the outlook for supply and demand in the years immediately ahead. Salient economic and statistical information on uses, consumption, United States production, imports and exports, and other data pertinent to United States needs and supplies. 35 pages.	Industrial Materials Series, Report No. M-5. United States Tariff Commission, Washington, D. C.
Acetylene	Report on an acetylene-making process which came out of extensive research to develop an electric discharge process for making products from natural gas and related petroleum fractions. The nature of this process (which has been tested in pilot plant operation) and its equipment. 40 pages.	"Acetylene From Hydrocarbons." Bureau of Industrial Chemistry, University of Texas, Austin, Tex.

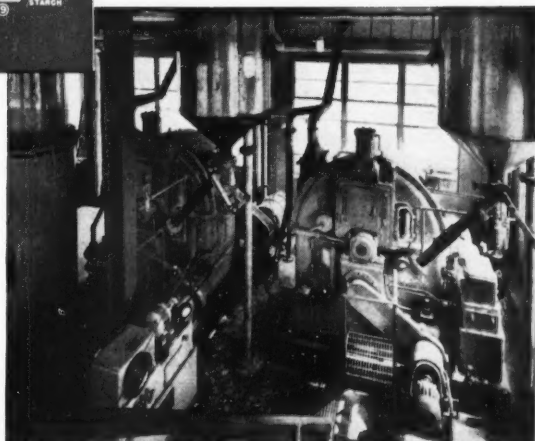
AMERICAN MAIZE-PRODUCTS COMPANY of Hammond, Ind. revolutionizes starch production with new flash drying unit and two BAKER PERKINS Centrifugals

New flash drying plant of the American Maize-Products Company is the first commercial application of flash drying to corn starch. The plant can handle approximately 300,000 lbs. of corn starch daily, an increase in the Company's starch drying capacity of more than 50%. And the quality of the product is far better than that produced by the old kiln method of drying. Two BAKER PERKINS ter Meer Centrifugals dewater starch slurry to a moisture content of 35% for the flash drying unit.



Flow sheet diagram of the new flash drying plant. This new method of drying corn starch is faster and more efficient than any other drying method now used in the corn refining industry. Production is higher; capital and operating costs are lower. And the two BAKER PERKINS Centrifugals shown in the diagram help keep production high and costs low for the American Maize-Products Company.

These two BAKER PERKINS ter Meer Centrifugals play a vital part in the successful operation of the flash drying unit. In this installation, they are fully automatic, but they can be provided with manual controls if necessary. A simple cycle controller makes complicated centrifugation cycles easy, and the control cycle will compensate for most any process variables. BAKER PERKINS Centrifugals are available in several capacities for production work as well as in laboratory and pilot plant models.



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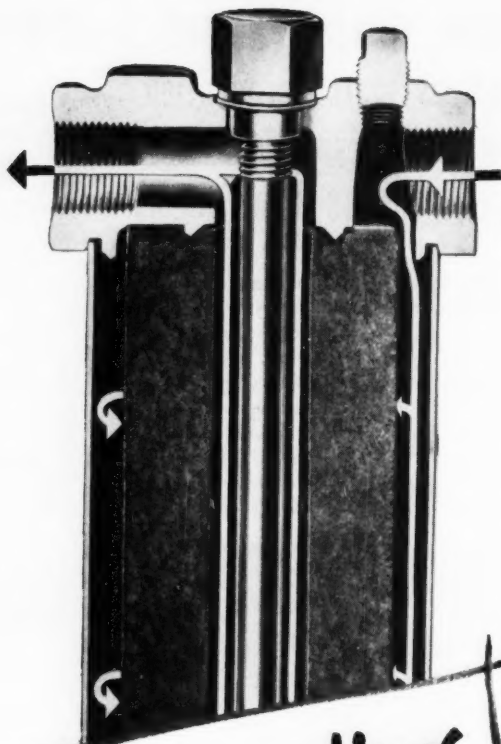
The cartridge gets its strength from resinous impregnation and polymerization.

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GUARANTEED to remove 100% of all solids for which it is rated plus a large percentage down to 1 micron. Cartridge densities: 10, 25, 50 microns. Capacities: a few to over 800 gpm.

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Clean raw water, recirculating water, etc.—**FLO-KLEAN**



STEAM JET HEATER GIVES LIQUIDS FAST, CONTINUOUS "HEAT TREATMENT"



FIG. 320.
SK
Continuous
Heater with
threaded
ends.

Economy conscious process engineers are finding a host of useful applications for the SK Steam Jet Pipeline Heater.

Designed for direct connection to plant steam lines, this heater operates on the jet principle, using steam and a cold liquid under pressure to mix and instantaneously heat the liquid. Heating is continuous.

Uses in process plants include: heating liquids in process; washing

down equipment; cleaning and scouring tanks, kettles, vats.

In operation, liquid under pressure enters the heater through a nozzle; steam, also under pressure, enters through a series of slanting nozzles in the combining tube. In the venturi throat, an intimate mixing of liquid and steam occurs, and the liquid absorbs the heat of the steam. The hot liquid is then discharged into a tank or through a piping system.

High velocity tank cleaning, as shown in the illustration, is a simple, swift, inexpensive operation with this equipment. Hot water is discharged under pressure through a hose and cleaning nozzle. The sizes of the heater and nozzle are determined by the water flow desired.

Operation is economical, efficient and trouble-free because: (1) there are no moving parts except an adjusting spindle; (2) liquid flow is regulated by the spindle; (3) all of the heat from the steam is directly absorbed by the liquid being heated; (4) mixing is uniform and controlled; (5) the unit is small, compact in size; and (6) no loss in liquid pressure occurs under normal conditions. For detailed information on all types of SK Jet Heaters, request Bulletin 3-A.

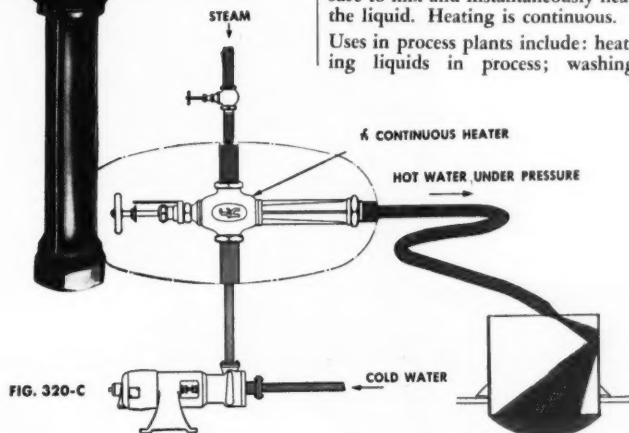
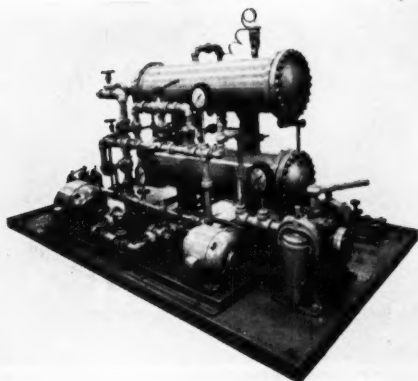


FIG. 320-C



The "Packaged" SK Duplex Pumping, Heating and Straining Unit, illustrated, is being used in the modern power plant of the National Brewing Co., Baltimore, Md., to feed Bunker "C" Fuel Oil to the oil burners. For information on this equipment, request Bulletin 16-A.



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Prior to the Pfizer fermentation process, the manufacture of Citric Acid depended mainly on imported citrate of lime. When this crude material was in short supply, the manufacture of Citric dwindled and prices were forced upward.

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	Chemical Workers in 1951	Percent Increase, 1949 to 1951
Argentina.....	39,900 ¹	-1.7 ¹
Australia.....	36,900	6.5 ²
Austria.....	29,500	5.4
Belgium.....	64,500	3.5
Canada.....	49,600	14.3
Chile.....	9,500	n.a.
Czechoslovakia.....	64,100 ²	n.a.
Denmark.....	15,700 ²	n.a.
Egypt.....	16,600 ²	n.a.
Finland.....	3,100	29.1
France.....	236,000	6.3
Germany, Federal Republic.....	307,000	16.7
Greece.....	22,000 ²	n.a.
India.....	63,300 ²	n.a.
Italy.....	111,000	0.4
Japan.....	307,300	n.a.
Netherlands.....	48,100	0.8 ²
Norway.....	15,400	37.5
Poland.....	159,000 ²	n.a.
Sweden.....	29,400 ²	n.a.
Switzerland.....	25,400	10.4
United Kingdom.....	488,300	12.8
United States.....	742,000	15.6

1. 1950. 2. Increase from 1950. 3. 1949. 4. 1948.

Many Workers, More Needed

Chemical industries throughout the world are finding themselves short of technical and operating manpower. Here are the highlights from ILO's report, just made public.

There's a worldwide shortage of chemical manpower. The reason: the great expansion of plant capacity that has taken place during the past few years.

In a report just made public in Geneva, the International Labor Organization reports that several countries—including some of the most important chemical producers—are beset by a shortage of manpower at all levels of industry: Production workers, technical staff and, primarily, chemical engineers.

Readers of this magazine have been kept informed on the chemical manpower situation in the United States.

They will not be surprised at the ILO statement that the problem appears to be most acute in this country.

► **British Plight**—Even before rearmament aggravated Britain's economic problems, the chemical concerns in that nation were faced with a shortage of engineers, chemists and skilled workers.

Two or three years ago the British chemical industry had—as national responsibilities—the jobs of exporting to the dollar area and of producing goods for the home market which would allow a saving of dollar exchange.

World events have since added new responsibilities. Mobilization placed

an additional burden on the industry. The chemical industry had to deal with the whole raft of problems arising from the serious raw material shortages that followed the Korean war.

The shortage of chemical engineers in England is particularly acute. Chemical engineering as a profession never gained the status there that has been so evident in the United States for several decades.

As a result, very few chemical engineers are graduated from British schools and universities. Recently the number has been less than 200 yearly; in contrast, last year schools in the United States graduated some 3,800 chemical engineers.

But British universities are training more chemists than ever before. Yet they can't keep pace with industry's requirements.

Historically, British universities were slow to include chemistry in their curricula. University administrators used to feel that chemistry wasn't a proper subject for a gentleman. And—as a report on the history of Oxford University puts it—the students were distressed by the unpleasant laboratory smells.

The present manpower shortage is compounded by the fact that the future engineer or chemist must put in two years of military service either before or after graduation.

In search for remedies, Britain has reconstituted the Technical Personnel Committee which dealt so successfully with scientific manpower questions during World War II. The Association of Chemical Engineers has suggested the introduction of part-time courses in chemical engineering in order to boost the existing crop of technical manpower.

► **Other Nations, Too**—Belgium, France and the Union of South Africa also report a scarcity of chemical engineers. Belgium and France are concerned because they fear the number of engineers will not be adequate to meet the growing demands of industry. But the shortage in South Africa is so serious that it has caused a considerable delay in the nation's industrial development.

ILO reports unemployed chemical

NOW
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 moisture
 content
 rapidly,
 accurately,
 automatically!*

THE BECKMAN AQUAMETER

The Beckman Aquameter brings added speed and accuracy to routine moisture analyses of such products as pharmaceuticals, alcohols, ethers, solvents, antibiotics, food products and a host of other materials sold on a moisture-free basis. It is also extensively used in processing operations where moisture is a key indication.

Other techniques now used for determining moisture (oven-drying, distillation, etc.) are tediously time-consuming and necessitate complex expensive equipment. Manual titrations require the skill of highly trained technicians experienced in interpreting and identifying gradual color variations. But the simple, fully automatic operation of the Beckman Aquameter reduces titration time to an average of only one or two minutes, and most titrations can be reproduced to within ± 0.05 ml.

Titrations performed on the Aquameter are reproducible to 0.05 ml of KF Reagent, which corresponds to a few tenths milligram of H_2O —a sensitivity unsurpassed by any other routine method.

The Beckman Aquameter applies a new principle to the "dead stop" technique, recognized as the most sensitive of the instrumental methods for Karl Fischer titrations, and recommended by the U. S. Pharmacopoeia. Initial adjustment is simple and easily made, and any number of sequential titrations can be carried out with no further checking or setting, simply by adding the sample and pushing a button. The titration is completed automatically and without attention.

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ECONOMICS, cont. . .

workers in several countries. In general, they are production workers. These are often listed as unemployed because they are in the process of changing jobs. Or they may be people who are listed with their national employment bureaus although they may not be actively looking for employment.

Whatever the reason, it is clear that—to quote the ILO report—"even in countries in which there is unemployment, the numbers are few in the chemical industries as compared with the total number unemployed in industry as a whole."

► **Women on the Job**—The actual number of women employed in manufacturing chemicals has, with rare exceptions, risen during recent years. But the percentage of women as compared to men employed shows slight increases in some cases and slight decreases in others.

In Belgium the percentage of female employees has risen from 21 percent to almost 25 percent over the past few years. In Norway the increase has been from 10.8 to 12.2 percent. In Western Germany, however, the percentage has remained constant at about 27 percent over the past several years.

In the United Kingdom, Canada, Sweden and the Netherlands, statistics for the past three years indicate a slight decrease in the percentage of women employed in chemical operations.

► **High Ratio of Salaried Workers**—A characteristic of the chemical industry throughout the world is the large number of salaried workers as compared with the total number of employees.

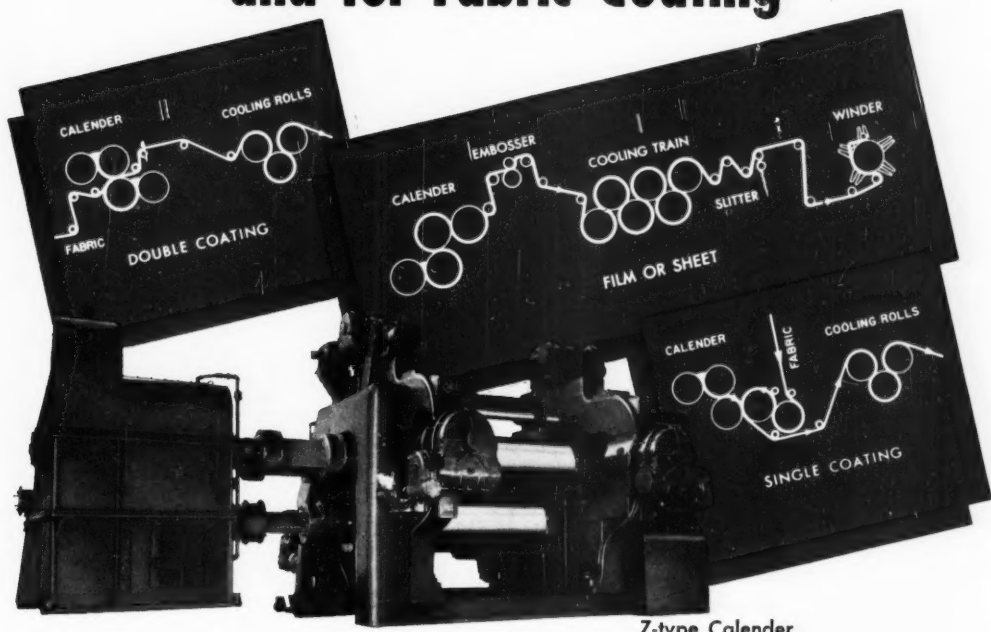
For industry as a whole the proportion of salaried employees is 15.6 percent. But the chemical industry has far and away the highest proportion of salaried employees—25.2 percent—of any industry.

The explanation is that the chemical industries, because of the extent to which they are mechanized, need comparatively few workers in proportion to the size of the technical staff.

In the United States the percentage of salaried employees—40 percent—is tops. Sweden ranks second with 30 percent. In Britain, Belgium, the Netherlands, Greece, Austria and Chile salaried employees make up from 18 to 25 percent of the total number of employees.

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For High-Speed Production of Film and for Fabric Coating



Z-type Calendar

Farrel-Birmingham is generally recognized as the world's leader in the design and manufacture of calendar trains for high-speed production of film and for fabric coating. In the last few years, the company has built more than one hundred plastics calenders and the latest Z-type design has been specially developed for this exacting work.

Here is what this vast experience means to you:

ACCURACY and VERSATILITY—The Z-type calendar can produce unsupported vinyl film to gauge as light as 1.7 on a commercial scale, with linear gauge held within .0001". Transverse gauge, also, can be accurately controlled throughout a wide range by means of a motor-operated device for crossing the roll axes. The performance records of one installation indicate that accurate gauge material is produced over a range of .004" to .020" by utilizing this means of adjusting roll "crown."

SPEED—Farrel-Birmingham calenders are designed for maximum production speeds greater than chemical limitations, at present, permit.

ENGINEERED LAYOUTS—The company has specialized in engineering calendar trains, incorporating an embosser directly off the calendar, cooling train and windup (see diagrams). Other units, such as Banbury mixers and mills, matched in capacity with the calendar train, can also be supplied to make production a single, integrated operation.

Farrel-Birmingham engineers will be glad to discuss your calendaring requirements with you at any time. Why not call them in for consultation today?

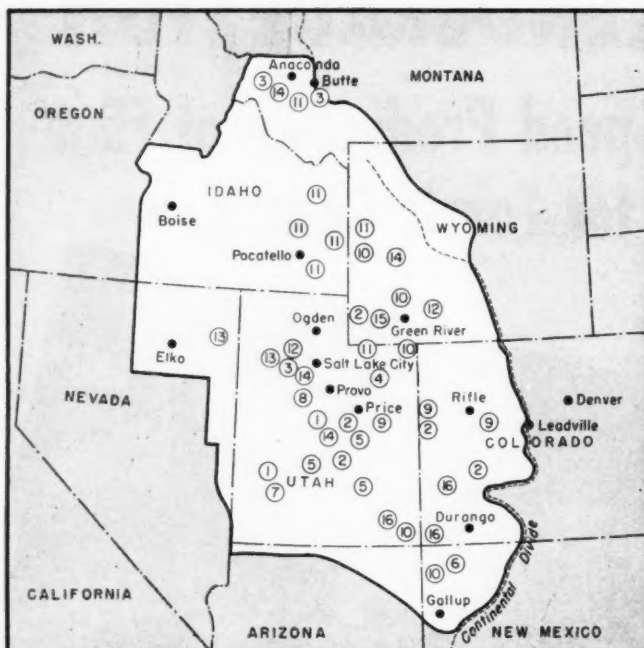
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FB-754 A

Farrel-Birmingham®

A Regional Survey



LEGEND:—

- | | |
|-------------------|---------------------------------|
| 1. Carbon dioxide | 9. Oil shale |
| 2. Coal | 10. Petroleum, nat. gas |
| 3. Copper | 11. Phosphates |
| 4. Gilsonite | 12. Potassium salts |
| 5. Gypsum | 13. Salt |
| 6. Helium | 14. Sulphur and SO ₂ |
| 7. Iron ore | 15. Trona |
| 8. Limestone | 16. Vanadium, uranium |

INTERMOUNTAIN AREA:

Raw Materials Aren't Enough

Our Intermountain West, with its vast natural resources, may be our last industrial frontier. Today it shows lots of promise—but no boom. Here are its problems.

ELLIOT SCHRIER

Take a look at that sprawling area west of the Rockies and east of the Sierras, that multi-square mile region of basins, plateaus and peaks that westerners sometimes call the Intermountain Empire.

You'll find that silica or sulphur, phosphate or potash, pumice or perlite—all occur in quantity in the Intermountain West. Name a mineral raw material of the chemical industry from antimony to zinc. Chances are

if you can't locate it in Utah you'll find it in Nevada—or Montana, or Idaho, or in the western slope country of Colorado and Wyoming.

But with its population of 1,250,000 thinly spread in a number of irrigated valleys, the Intermountain West offers but a meager, widely dispersed market for any product.

As one industry spokesman put it recently: "This Intermountain area is still a fief. We look to New York for financing, to San Francisco for field supervision—and to God for a market."

Visual emphasis is given such remarks by the sun-baked skeleton of a post-World War I potash plant on

the rim of the Utah-Nevada desert near Wendover. When German potash reappeared the Utah operation proved uneconomical.

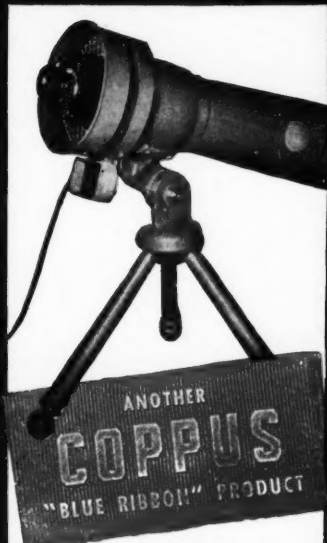
Remnants of a sodium sulphate plant that bloomed for three years on the desert fringe near Great Salt Lake, only to go under in 1940, likewise illustrate the marketing troubles faced by Intermountain hopefuls. Sodium Products Co., after staking out a market in the paper industry, found itself unable to operate profitably when faced with shipping costs of \$10-12 per ton to Great Lakes points and \$6.60 per ton to the Pacific Coast.

► **Promise With Handicaps**—Today, industry faces a great potential in the Intermountain country. The region is closer to pulling itself up by its bootstraps than ever before in its hundred-year history.

But hard-headed students of the region point out that as long as freight rates remain on a 15 percent plateau

ELLIOT SCHRIER, our roving Western Editor, has just come back from a trip through the Intermountain area. Here are his findings, prepared with the aid of Jack Goodman—Our Salt Lake City correspondent—and other C. E. correspondents scattered throughout the region.

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| | <input type="checkbox"/> around cracking stills. |

- | |
|---|
| <input type="checkbox"/> exhausting welding fumes. |
| <input type="checkbox"/> stirring up stagnant air wherever men are working or material is drying. |
| <input type="checkbox"/> drying of walls, sheets; etc., after treated with coating material. |

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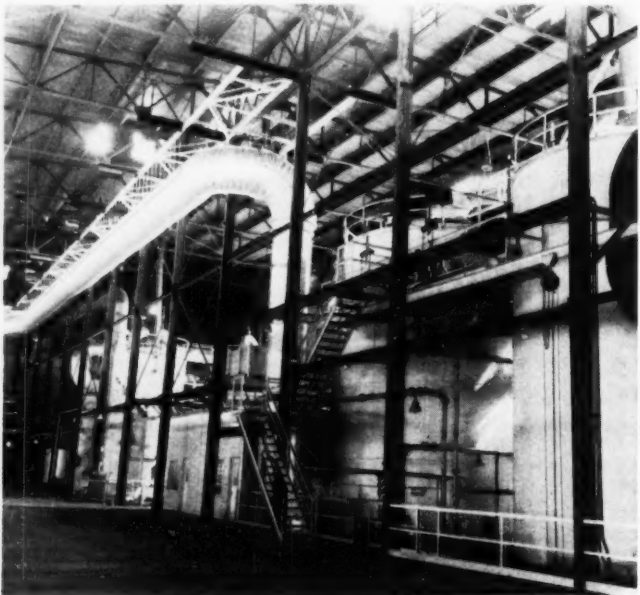
CITY

(Write here any special ventilating problem you may have.)

Growth Is Based on Abundant Materials



PHOSPHATE ROCK: The Intermountain area claims close to a quarter of the world's major phosphate reserves. This is Simplot's open-pit mine near Pocatello.



SULPHURIC ACID: Largest producer is this plant of American Smelting & Refining Co. at Garfield. Area's output will reach 700 tons daily by 1953.

they will appear forbiddingly high to anyone seeking to move large tonnages across these vast spaces; that high electric power rates (roughly 1.5¢ per kwh.) forced mighty Kennecott Copper to build and operate its own power plant, which now produces 6-mill power for Kennecott's operations and a surplus for sale to local utilities; that industrial natural gas supplies, which seemingly should be available in this well-dotted region, are scarce and interruptible.

► **Freight Rates**—When U. S. Steel began operating its Geneva plant at Provo, it managed to hammer freight rates down to a reasonable 96¢ per hundred-weight for steel movements to the West Coast—after the railroads had first quoted a rate twice that high.

But U. S. Steel can swing a bigger sledge-hammer than most prospective Intermountain industries. Manufacturers seeking to set up shop in the Intermountain region now take a long look at freight rates—and usually decide to build on the Pacific Coast where water-carriers help keep rates down or on the eastern slope of the Rockies just outside the mountain zone's 15 percent rate plateau.

Only recently have citizen rate associations begun to seek relief through organized appeals to ICC. They claim that the 15 percent rate differential stems from days when the cost of shunting freight across the mountains was set by inefficient steam locomotives.

Now, they note, diesels have reduced the mountain-flatland differential; long hauls in the mountains (with few stops) should cost no more than hauls in the eastern or midwestern areas where frequent starting and stopping counterbalances up-hill, down-hill costs.

► **Power**—Mention electric power costs to Intermountain industrialists and the reaction is sharp and sure. They—particularly the little fellows—will insist their power costs are in the neighborhood of 1.5¢ per kwh.

But power company executives see the picture differently. Utah Power & Light Co., a progressive firm representative of the region's five privately-owned major power companies, provided 437 million kwh. to its industrial customers at 1.13¢ per kwh. in 1950.

Oil refineries, however, received their power from UP&L at an aver-

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Here's a problem. The equipment has small cracks at (a). Will repairs be costly, long-winded jobs? Not if it's HAVEG.

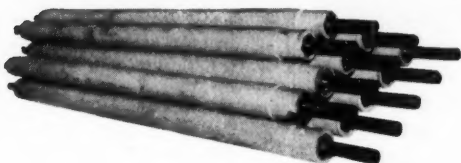
Repair HAVEG in the field. Chip out "V" grooves following clear instructions. Equipment does not have to be removed from foundation.

Cement is applied quickly after mixing. In some cases after initial set, heating may speed hardening. As soon as cement is completely hard equipment can be used.

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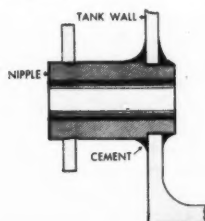
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REGIONAL SURVEY, cont. . .

age of 0.84¢ per kwh. while Monsanto Chemical Co. in Idaho is believed to be purchasing the huge power supply it needs at a price in the neighborhood of 6 mills per kwh.

Power company spokesmen note they cannot compete—with their coal-fired, oil-fired and small hydro plants—with the low rates charged by Texas companies that generate their power with "waste gas." Nor can they compete with the giant government-owned Pacific Northwest and TVA installations.

But, they insist, Intermountain utilities will sit down with prospective industries and "thrash out" reasonable rates. What's more, they say, they'll make power available—more than Pacific Northwest suppliers can now promise.

► **Natural Gas**—Industrialists discouraged by the current state of Intermountain development point with some heat to the area's lack of a non-interruptible industrial supply of natural gas. Sharply involved in "warfare" between Mountain Fuel Supply Co. (the existing gas utility) and new concerns attempting to enter the field, they claim conservative MFS is responsible for shortages due to "unwillingness to really explore."

But the situation is not all black. MFS's president W. T. Nightingale notes that his firm has produced and marketed over 300 billion cu. ft. of gas in the region since 1929. What's more, it now owns or controls 609 billion cu. ft. of proved resources in nine Utah, Wyoming and Colorado fields linked to the region's Salt Lake Valley heartland by 694 miles of pipeline.

But its 85,000 customers are chiefly domestic. After bringing in a new 20 million cu. ft. per day well in northwestern Colorado this spring (indicating a field MFS officials feel may satisfy "all the region's needs") the utility asked permission to add 6,000 more homes to its lines.

Yet industrial supplies still cannot be guaranteed, although MFS, having invested \$15 million in production and distribution facilities since 1949, reports newly developed wells will allow a peak daily load increase of 12.4 million cu. ft.

Meantime, before the Utah Public Service Commission and in the courts, Utah Natural Gas Co. and other potential suppliers have been

seeking to bring in gas from the Utah-New Mexico-Arizona-Colorado "four corners" region or from test wells in Utah's Carbon County.

► **Markets**—Freight rates, power rates and natural gas supplies: these are major problems facing the Intermountain area. But the largest problem by far is the lack of close-in markets.

The area is rich in raw materials, has sufficient water available or in sight, labor enough, coal aplenty, steel and petroleum industries upon which to base a chemical industry.

But until a market develops, either through some unexpected upsurge in population or a complete overturn in rate structure, the Intermountain's industrial status in the chemical field will develop slowly. The region, say even its heartiest boosters, will remain principally a center from which raw materials are sent 1,000 or more miles for processing, converting or fabrication.

There are, of course, exceptions.

► **Oil**—Chief promise for chemical expansion in the Intermountain area lies in the recent and rapid growth of petroleum output. All major oil companies in the area plan to refine their crude on the spot, shipping products rather than crude to established markets. This will bring about an expansion in refinery capacity—an encouraging sign to area boosters.

This year's Carter Oil strike in Utah's Willow Creek sector gave new weight to beliefs that many upland basins will be potent producers within a dozen years. Not as spectacular as almost simultaneous North Dakota and Montana discoveries just outside the Intermountain periphery, Utah's Uintah Basin fields are nonetheless so promising that 31 major oil companies and independents are now probing sectors of Idaho, Nevada and Utah that once seemed hopeless.


Small by California and Gulf Coast standards, Intermountain's crude production totaled a respectable 31.4 million bbl. in 1951. Of this, some 1.3 million bbl. came from Utah's 42 producing wells—all brought into production since late 1948.

In the face of enormous transportation costs and technical problems posed by the high wax content of some Utah crudes, 47 additional wells are being drilled by operators in 13 Utah counties; 1,211 other wells are scheduled to be drilled in the Intermountain area this year.

And should shale oil refining or

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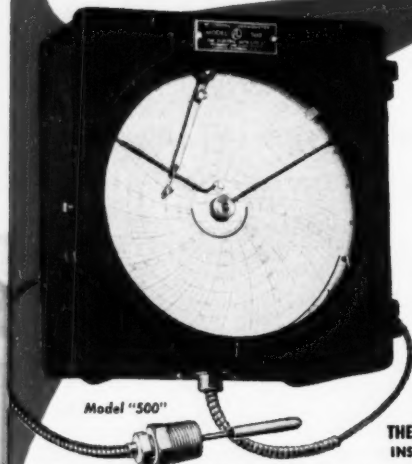
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REGIONAL SURVEY, cont. . .

gasoline-from-coal techniques ever pay off, this is the region that'll benefit: oil-rich shale deposits and coal beds containing at least 530 billion tons (more than the bituminous reserves of all Europe) underlie a sizable swatch of Utah, Wyoming and Western Colorado. An extensive rock asphalt deposit, potentially as valuable a source of petrochemicals as Alberta's much-touted oil sands, also awaits technological developments.

Currently, oil lines with a 62,000 bbl. capacity bring crude from Utah, Wyoming and Colorado to Salt Lake refineries. Late this year the 310-mile Pioneer Pipe Line, an eight inch being built by Continental and Sinclair, will begin moving products from Sinclair, Wyo., to the Utah capitol city.

Salt Lake Pipeline Co. (Standard of California) pumps 22,000 bbl. of refined products daily northwest to Pasco, Wash. And late this year its two-year old line will be paralleled as far as Boise, Idaho, by an \$8-million, 330-mile twin.

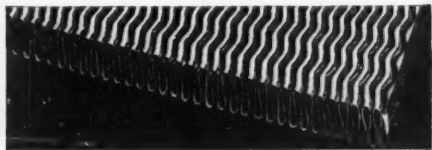
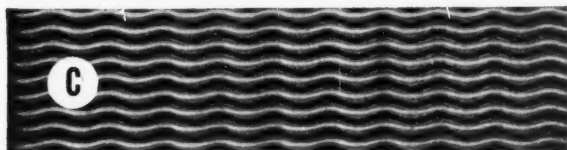
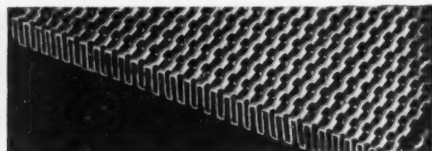
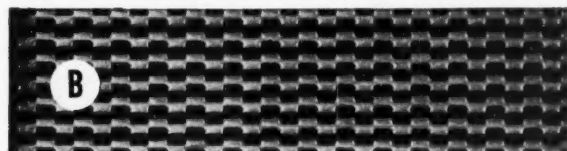
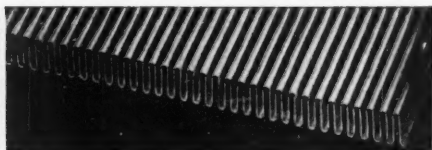
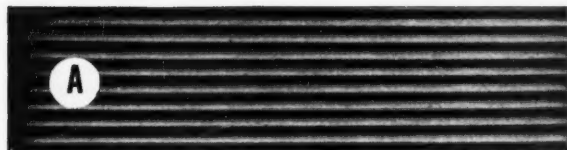
Utah Oil Refining Co. (Standard of Ind.), Phillips Petroleum and such independents as Western States Refining Co. and Uintah Oil Refining Co. are obviously in the Intermountain country to stay. Utah Oil spent \$4 million at Salt Lake alone during the past two years, put \$1 million into exploration, now has a physical plant investment of \$40 million. It refines 25,000 bbl. of crude daily and manufactures some 200 assorted products.

The 4,000 bbl. daily capacity of Phillip's Woods Cross refinery has just been boosted to 10,000 with a new 8,000-bbl. cracker. Phillips, which absorbed homespun Wasatch Oil's production and distribution facilities in 1947, also has small refineries and tankage in Idaho and Montana.

Best-informed guess on any petrochemical development: it'll come when refineries in the Salt Lake area reach a 100,000 bbl.-per-day output. This could conceivably be reached in two years.

And in the longer pull, there are definite possibilities in a chemical industry based on shale oil and coal hydrogenation. Chemical company representatives are now surveying the area's exploitable coal deposits.

► Phosphates—While development of many Intermountain resources has



Three of the many types of fin section available.

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With Trane Brazed Aluminum Heat Exchangers, you choose from a great variety of surfaces in solving exactly your heat transfer problems. They may be straight and continuous (A). They may be serrated (B). Or they can be of herringbone design (C). With these basic designs, exactly the right surface can be selected to provide the correct ratio of heat transfer to pressure drop characteristics.

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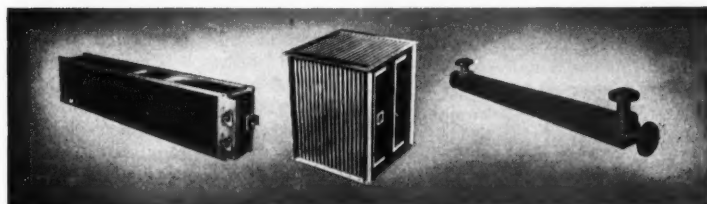
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just the heat transfer, just the pressure drop volume, velocity number and direction of passes you want with Trane Brazed Aluminum Heat Exchangers.

Design flexibility is but one of the many advantages of Trane Brazed Aluminum Heat Exchangers. Compared to conventional exchangers, they produce more heat transfer efficiency in $\frac{1}{4}$ the space with $\frac{1}{2}$ the weight at approximately $\frac{1}{2}$ the cost.

These all-aluminum heat exchangers are rugged, too. They take test pressures up to 1,000 pounds per square inch and temperatures from -300° to 500° F.

Whether the job calls for high or low temperatures or pressures, one stream or many, Trane Brazed Aluminum Heat Exchangers can be the answer. Contact your Trane sales office or write direct.



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Pangborn CH Dust Collectors installed outside the Kingsbury shop collect dust from painting and finishing operations via booths and hoods.

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Hoods exhaust dust from hand polishing and grinding booths to outside Collectors

FINISHING operations at Kingsbury Machine Tool Corporation presented a 6-fold dust control problem to Pangborn engineers. Several priming, lacquering and spray painting operations had to be protected from dust created in other finishing jobs such as snagging, grinding and smoothing.

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Kingsbury reports the complete system "highly satisfactory"—with these added benefits: Heating costs have been lowered substantially through recirculation of the cleaned air. Costly dust damage to adjacent machinery and products has been prevented. And workers' efficiency has increased due to cleaner working conditions.

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REGIONAL SURVEY, cont. . .

lagged, a healthy start—and one that may set a pattern—has been made in phosphates.

Southern and eastern Idaho, western Wyoming and northern Utah claim one-fourth of the world's major phosphate rock reserves; with growing fertilizer and detergent demands, both mining and processing are advancing rapidly.

Upwards of a million tons of phosphate rock came from Idaho in 1951, chiefly from the Pocatello sector. J. R. Simplot's open-pit on the Fort Hall Indian reservation alone produced 800,000 tons, should boost output 300,000 tons this year.

Monsanto Chemical Co. will soon open its \$5 million electric furnace, touted as the world's largest, at Soda Springs, Idaho. Scheduled to produce 10 percent of the nation's elemental phosphorus, the operation will require 300,000 tons of Idaho rock, 30,000 tons of Utah coke and coke breeze and 30,000 kwh. of UP&L juice annually.

Monsanto has solid hopes for the region. Including those purchased from Simplot, it has 15 Idaho leases, involving 4,500 acres of federal land. The company reportedly plans to double its phosphorus potential by erecting a second furnace on completion of its initial \$5 million program. Monsanto also has extensive phosphate leases near Vernal, Utah, a district ready for development if and when controversial government dams proposed for the Green and Yampa Rivers produce a cheap source of power.

At Pocatello, Westvac is adding a \$4.5 million fourth furnace to its present battery to give elemental phosphorus output another sizable jog.

Meantime, others are profitably developing high-grade phosphate deposits for superphosphate manufacturers. Anaconda Copper has been bringing out substantial tonnages from its Idaho underground diggings since the early 20's.

San Francisco Chemical's long profitable operation at Lefee, Wyo., its reactivated mill in the Montpelier district, and its operations at Caribou-Bear Lake process 10,000 tons of phosphate rock monthly for midwest shipment. And Victor Chemical has a second \$5 million elemental phosphorus furnace under construction at Silver Bow, Mont.

Meanwhile, Gates Bros., Inc., is making wet-process phosphoric acid and some 30,000 tons of triple super per year at its recently-built plant at Wendell, Idaho. This is the first privately-owned continuous triple superphosphate plant in the U.S.

Central Valley Farmers Fertilizer Co. of Chicago is reported to have plans for a furnace near Georgetown Canyon to produce triple superphosphate for midwest markets. Western Fertilizer Co. plans a \$2 million processing plant adjacent to the Dry Ridge mine near Soda Springs.

Just recently Stauffer Chemical, American Smelting & Refining and Kennecott Copper announced their plan to build a plant near Salt Lake City. The \$5 million plant will make phosphoric acid by the wet process and turn out some 60,000 tons a year of concentrated phosphate fertilizers. It will go on stream during mid-1953.

► **Trona & Soda Ash**—Westvaco is rapidly developing a mammoth trona mining and soda ash refining operation on Union Pacific's mainline near Green River in southwestern Wyoming. The \$16.3 million plant, based on pilot plant runs that began in 1947, is due for completion in 1953. It is owned jointly by Food Machinery and National Distillers, with Westvaco as property manager and sales agent.

Producing 300,000 tons of refined soda ash annually from 650,000 tons of trona, the 200,000 sq. ft. plant will employ 400 men, is based on reserves known to contain a quarter of a billion tons of high-purity sesquicarbonate—enough to supply all U.S. soda ash needs for 35 years at current rate of consumption.

► **Uranium**—While figures on the Intermountain output of uranium remain top secret, it's obvious that despite intensive prospecting elsewhere throughout the nation, the region centering around Rifle, Colo., and Marysvale, Utah, is still the AEC's top domestic A-ore source.

Upwards of 300 mines produce varying tonnages and grades of carnotite and autunite ores for the defense effort, with hints of pitchblende output now on the Intermountain region's eastern fringe near Leadville, Colo., in Utah's Grand County, and on the huge Navajo Reservation. Two ore buying stations and eight mills handle the output of the widely scattered mines.

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with Hydro-Finish!**



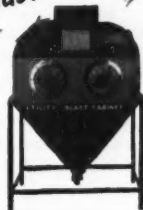
Removes scale and directional grinding lines . . . prepares surfaces for plating and holds tolerances to .0001"! Liquid blast reduces costly hand cleaning and finishing of molds, dies, tools, etc. Models from \$1410.00 and up.

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Pangborn industrial type Unit Dust Collectors trap dust at source. Machine wear is minimized, housekeeping and maintenance costs reduced. Solves many grinding and polishing nuisances and material losses. Models from \$286.00 and up.

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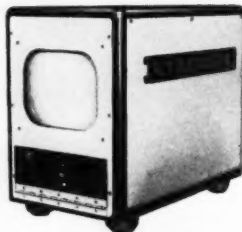


Eliminate
QUESTION MARKS THAT
Waste Time and Money

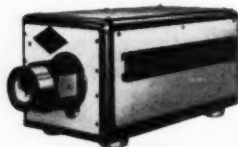
Use the **DIAMOND** "UTILISCOPE" (WIRED TELEVISION)

No production system is entirely automatic or perfectly integrated, because many operations and processes refuse to be self-disciplined . . . they must be watched. Often several operations need watching simultaneously to keep them in step. Such irregularities and uncertainties are a continual source of question marks that waste time and money.

The Diamond "Utiliscope" (wired television) enables you to eliminate these question marks. With it your supervisory staff can SEE what is going on at remote, inaccessible or dangerous points. A clear picture is transmitted of what is happening AS IT HAPPENS. Installations in many kinds of plants have proved that the "Utiliscope" can make important savings of time, money and manpower . . . in addition to improving safety. For further information, ask for Bulletin 1025C.



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Coordinating materials flow on conveyors. • "Utiliscope" (Reg. U.S. Pat. Office)

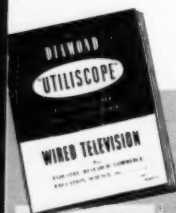
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WRITE FOR
BULLETIN 1025C

REGIONAL SURVEY, cont. . .

American Smelting & Refining Co. operates ore-purchasing depots for AEC at Monticello and Marysvale in Utah. Uranium mills are officially reported at: Grand Junction, Colo. (Climax Uranium Co.); Monticello, Utah (Gallagher Co.); Uravan and Rifle, Colo. (United States Vanadium Corp.); Naturita and Durango, Colo. (Vanadium Corp. of America); Hite, Utah (Vanadium Corp. of America); and Salt Lake City (Vitro Chemical Co.).

Further aspects of the regional role in AEC efforts: chief raw materials procurement and field offices for the government agency are located at Grand Junction; AEC's reactor testing station—ultimately to cost \$350 million—is at Arco, Idaho, squarely inside the Intermountain area; the Los Alamos and Sandia, N. M., installations closely border the region, as do the test sites in Nevada.

► **Salt**—Salt reserves in the Great Salt Lake area are said to be big enough to supply world needs for 1,000 years. That big lake contains 6 billion tons of salines in solution; rock salt of high iodine content can be mined readily, and magnesium and sodium sulphates could—according to some experts—be produced at the site with real economy.

But again the picture is darkened by the problems of high freight rates and limited markets.

Royal Crystal Salt Co.'s plant at Saltair on the Great Salt Lake supplies most of the 120,000 tons consumed annually by the Intermountain market. But shipping salt west to California population centers is another matter: solar evaporation makes Coast salt as low-cost as Utah's, while Utah salt moving east cannot compete with Hutchison, Kan., mines and wells. It's the 15 percent Intermountain freight rate plateau again.

► **Potash**—A striking illustration of the area's economic facts of life can be found at Wendover, Utah, astride transcontinental U.S. 40 and Western Pacific's mainline.

Here, on Utah's white-caked flats, Bonneville, Ltd., uses free sunshine and cheap brine to produce muriate of potash. Collected by 50 miles of canals draining 50,000 acres, the brine is concentrated until the potash content increases from 1 to 30 percent. Flotation brings it up to 95 percent.

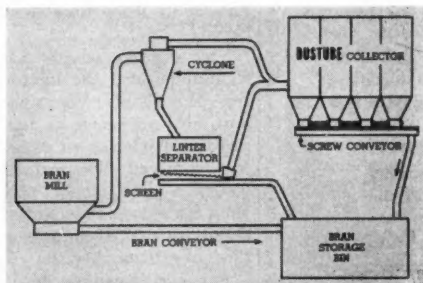
Most of Bonneville's production

Salvaging dollars

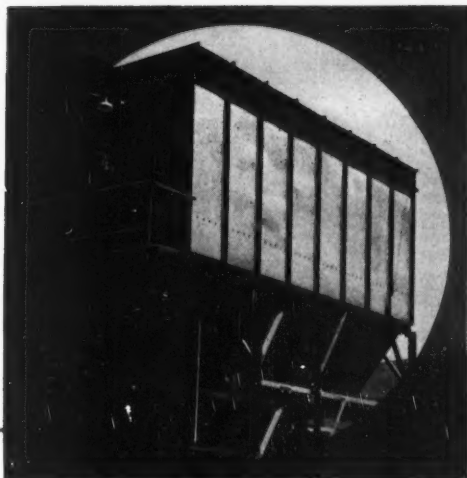
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PROCESS DUST with
the **DUSTUBE®** Collector

at FARMERS' AND GINNERS'
COTTON OIL COMPANY

ALTHOUGH the meat packer proudly claims a use for everything but the pig's squeal, even the processing dust created in cotton seed by-products production is profitably salvaged at Farmers' and Ginn's Cotton Oil Co., Birmingham. This firm not only extracts oil from the seed, but they also obtain valuable cattle bran feed and linters or fibre from the seed hull.



Flow chart illustrates how the Dustube Collector ventilates all dust creating operations and salvages valuable bran feed.



This Dustube Collector annually salvages over \$7000 worth of valuable cotton seed bran feed.

In the Fibre Department, dust consisting of marketable material had always been a problem. Its escape into the atmosphere created extremely dusty conditions adding to plant maintenance costs, and its extreme fineness and other characteristics made it a fire hazard. Cyclone collectors and a large settling room were ineffective.

SAVES \$7000 ANNUALLY

Addition of a high efficiency Dustube cloth-tube type Dust Collector to the system solved this problem—and at a profit. The Dustube Collector filters the dust laden air so that only clean air is discharged. Salvaged dust is now automatically returned to the process at an estimated savings of over \$7000 annually.

Results of Dustube Collector efficiency like this are duplicated throughout the chemical processing industry. Dustube engineers will be glad to show you how your dust and fume problems can be handled with equal efficiency. Write today for Catalog 72-B.

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Only Sparkler horizontal plate design gives you the equivalent of *two* standard filters in just *one* tank.

By keeping a spare cartridge of plates ready at all times your filter need never be shut down for longer than it takes to hose down the tank and exchange the cartridge of dirty filter plates for a cartridge that is freshly dressed. This not only speeds the return of the filter to full production duty but also makes it easy for the filter operator to clean the plates whenever and wherever it is most convenient.

Besides eliminating the need for a standby filter, a spare Sparkler cartridge minimizes downtime, cuts labor costs, and makes your entire filtering operation a simple job that can be handled by just one man.

*Manufacturers of
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REGIONAL SURVEY, cont. . .

goes to midwestern fertilizer makers; some of it comes back to Intermountain farms at round trip freight costs.

But a native market is developing. Whereas Bonneville sold less than one ton of its product in the Intermountain region 10 years ago, it sold 400 tons to newly-established Intermountain fertilizer mixers in 1951.

Raw brine used by Bonneville has a value of 12¢ per ton; solar energy used during the 90-day summer season is equivalent to about 5,000 tons of coal daily for 300 days. These low costs are the sole reason why Bonneville's 76,000 tons per annum can move east profitably despite freight bills of nearly \$1 million a year.

Unfortunately, salt doesn't command as ready or as profitable a market as muriate of potash. Thus thousands of tons of byproduct salt go to waste annually at Bonneville's brine beds.

► **Sulphur & Sulphuric Acid**—Chemical Corp. of America recently started up its 100-ton-per-day pilot mill at Sulphurdale, Utah. The mill rests on reserves of over 3 million tons of ore averaging 25 percent elemental sulphur. If and when the beneficiation process proves sound a commercial mill with a capacity of 2,000 tons per day will be built.

Black Rock Desert Mineral Co. recently allocated \$100,000 to increase its output to 400 tons of agricultural and 125 tons of industrial sulphur daily at its Black Rock property in Nevada.

Vast deposits of low-grade ores occur throughout the Intermountain area—particularly in Wyoming—and at least three companies are actively engaged in developing an economic extraction process. The area may never become a prime supplier of sulphur, but it can become an important source during national emergencies or other times of extreme shortages.

American Smelting & Refining, linked to Kennecott's mammoth open pit and electrolytic refinery at Garfield, Utah, has opened its No. 4 sulphuric acid unit. This is part of an expansion program to boost regional production of that badly needed chemical to 700 tons daily by 1953.

► **Tungsten**—Tungsten ores currently being milled near the Nevada diggings will now be concentrated (in small tonnages) at Vitro Manufacturing Co.'s new Salt Lake plant.

Combined Metals Reduction Co.,

already handling some tungsten at its Pioche mills in Nevada, has purchased a mine and is expected to expand its processing operations. CMR also has done considerable experimental work in producing fossil resins from coal at its Bauer, Utah, plant; another small resin-from-coal operation is under way at Huntington, Utah.

► **Wax**—Sure-Seal Corp., now housed in ex-warehouse buildings at the World War II Salt Lake Airbase, started as a \$12,000 wax-making concern in 1944. It now has a \$250 thousand plant investment, sells \$700,000 of wax products annually. What's more, it hopes to build a \$5 million plant in the Uintah Basin near the Utah-Colorado border to utilize the excessively high (17 percent) wax content of some Uintah Basin crudes.

And Sure-Seal's owners are well aware of the fact (as are operators of American Gilsonite in the same district) that the Basin country is 100 miles from any railroad.

► **Fabricators**—Illustrative of the situation that chemical processors encounter in the Intermountain country is the dilemma confronting outspoken executives of Salt Lake City's Eimco Corp., a locally-born family enterprise that has grown, in half a century, to a top position among producers of filters for chemical, mining and food industries.

Were it not for the fact that its four multi-million dollar plants are where they are, Eimco would be more than happy to move its headquarters elsewhere. Only 2.3 percent of its 1951 sales were made in Utah, only 8 percent in the 11 Western States. Because of its far-flung markets, Eimco in particular operates under severe handicaps imposed by the area's high freight rates.

► **Steel**—But some industries can overcome those handicaps. This has been made clear by the success of U. S. Steel's Columbia-Geneva Steel Works.

With a 1,600,000-ton capacity, 10 open hearths, 16 soaking pit furnaces, 252 coke ovens and 7,100 employees Geneva has become one of the major steel plants in the nation and an increasingly important producer of chemicals—not the "white elephant" some forecasters predicted.

U. S. Steel also has 56 ovens at its Ironton mill. Except for tar distillation, expected to be installed in the next few years, both mills turn out a complete line of byproduct chemicals.

new Type Eppenbach COLLOID MILL

Featuring

Large Tangential Outlet which prevents back pressure and allows increased output capacity
Both Rotor & Stator are interchangeable
Stellite rings and stones—facilitating replacement when required.

Sanitary fittings throughout.
Illustration shows large production Mill Model QV-11 with 15 H.P. motor

Eppenbach Colloid Mills operate at speeds approaching the theoretical minimum required for true wet micro grinding—shaft speeds up to 10,000 r.p.m. depending on size and type of mill.

These Mills assure uniform grind through advanced engineering features including (1) Improved ball bearings which center the shaft and minimize lateral whip and (2) Invar shafting with zero coefficient of heat expansion.

All Mills can be made with pressure feeds and jacketed hoppers.

Consult our Sales Department with your technical problems.

Write for literature describing Eppenbach equipment—now manufactured and sold by:



Direct-drive model shown operates at 3500 RPM.
Higher speeds can be furnished.
Colloid Mills made in all sizes from 1/4 H.P. model laboratory size to 50 H.P. model.

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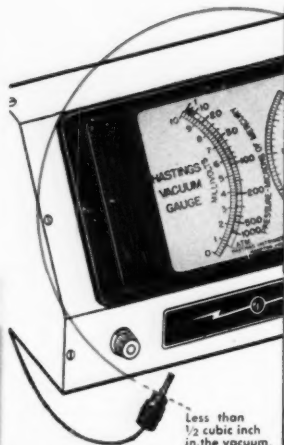
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REGIONAL SURVEY, cont. . .

But only tar, used as an open-hearth fuel, and ammonium sulphate are marketed in the Intermountain states. All other products are shipped mainly to the San Francisco Bay Area, with small amounts going to Los Angeles, the Pacific Northwest and Henderson, Nev.

About 10,000 tons of ammonium sulphate will also be produced as a by-product at Howe Sound's new Garfield, Utah, cobalt refining plant. But with USDA estimating an increase of about 150 percent over 1950 in Intermountain's use of nitrogen fertilizers by 1955, neither U. S. Steel nor Howe Sound is worried about disposing of its byproduct.

► **Plant Investment**—There are no figures readily available on the overall plant investment of the chemical and allied industries in the Intermountain region. Best estimate: \$205 million.

This total includes petroleum, \$100 million; phosphate and trona, \$55 million; cement, \$11 million; uranium, \$10 million (exclusive of AEC installations); clay, \$9 million; salt and muriate, \$7 million; sulphur and sulphuric acid, \$5 million; rubber products, \$2.5 million; cobalt, \$2 million (mainly Howe Sound's Chemico process plant at Garfield).

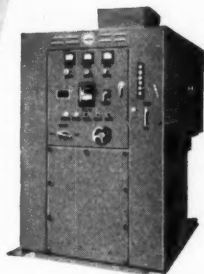
The entire area employs about 3,000 persons in the chemical and allied field. But there is a labor reserve in the Intermountain states (only recently Salt Lake City was declared a labor surplus area) and this employment figure should rise considerably as the area develops.

And the area is developing. There has been enough growth in the region in the past year or two to make necessary a \$61 million building program by Utah Power & Light to boost its generating capacity by 180,000 kw.

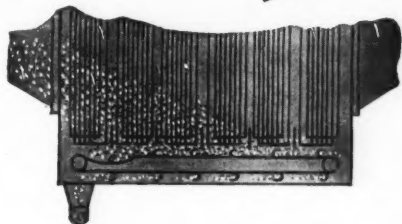
Whether this expansion will be sufficient depends upon population growth and revision of the basic freight rate structure of the area. These are factors beyond the usual control of the chemical industry. But with the vast amount of untapped resources in the area many industrialists might feel that the game is worth the candle.

Some day industry must come to its source of supply. That's the day the Intermountain area is looking forward to.

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This Koppers "packaged" mechanical or vacuum tube power pack is not restricted to an area near the precipitator. It can easily be installed in any convenient place in the plant. Result: Compact designs! More flexibility!



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Koppers engineers protect your investment in an electrostatic precipitator by guaranteeing both the recovery or gas-cleaning efficiency and the residual content left in the gas after cleaning. Koppers-Elex electrostatic precipitators are designed, engineered, fabricated, erected and guaranteed under one contract by Koppers Company, Inc.



IN ADDITION to high efficiency, Koppers concentrates on the practical aspects of electrostatic precipitator design. Shown above are just two of the many practical features which simplify operation.

Besides these compact power packs and the continuous dust removal features, Koppers-Elex electrostatic precipitators may be of the multiple-chamber type. This means one chamber may be shut down for inspection or maintenance without stopping the gas-cleaning action. The dirty gas is simply diverted through other chambers where cleaning continues.

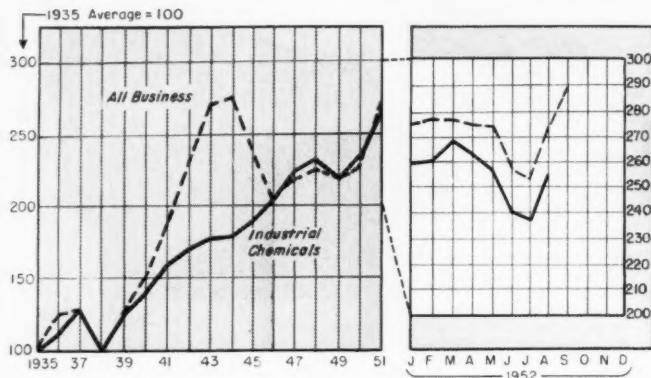
Because rapping is sectionalized, re-entrainment is minimized. And because successive collection fields can be separately energized, maximum voltage can be applied to each field—with higher gas-cleaning efficiency resulting. Pressure drops are negligible.

IF YOU HAVE A GAS-CLEANING PROBLEM, write and outline the details for us to review. There is no obligation. Just address your letter to: KOPPERS COMPANY, INC., Precipitator Dept., 310 Scott Street, Baltimore 3, Maryland.

Koppers-Elex **ELECTROSTATIC PRECIPITATORS**

Process Industry Trends

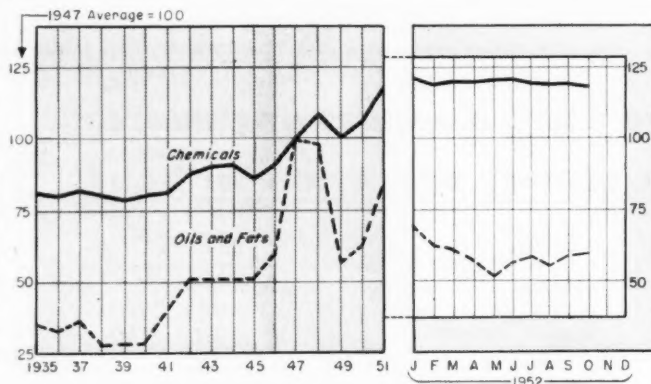
CONSUMPTION



Industrial Chemicals Index

	August (Est.)	July (Prelim.)	June (Revised)
INDEX	255.00	233.97	239.13
Fertilizer		56.01	56.53
Pulp and paper	27.83	24.67	27.27
Petroleum refining	28.57	28.06	26.46
Iron and steel	15.59	2.98	3.01
Royan	30.56	28.20	25.90
Glass		22.86	22.89
Paint and varnish		27.00	29.46
Textiles		8.79	10.55
Coal products		2.50	1.94
Leather		4.82	4.06
Explosives		7.40	8.23
Rubber	5.31	5.16	5.85
Plastics		14.92	15.38

PRICES

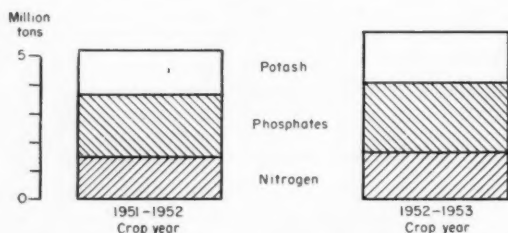


Chemical Engineering's Price Indexes

	Chemicals	DOWN - 0.3%
	Oils and Fats	UP + 2.3%
As of Oct. 1, 1952	119.08	59.81
Last month	119.47	58.30
Oct. 1951	119.43	75.31
Oct. 1950	111.99	71.01

HIGHLIGHT OF THE MONTH

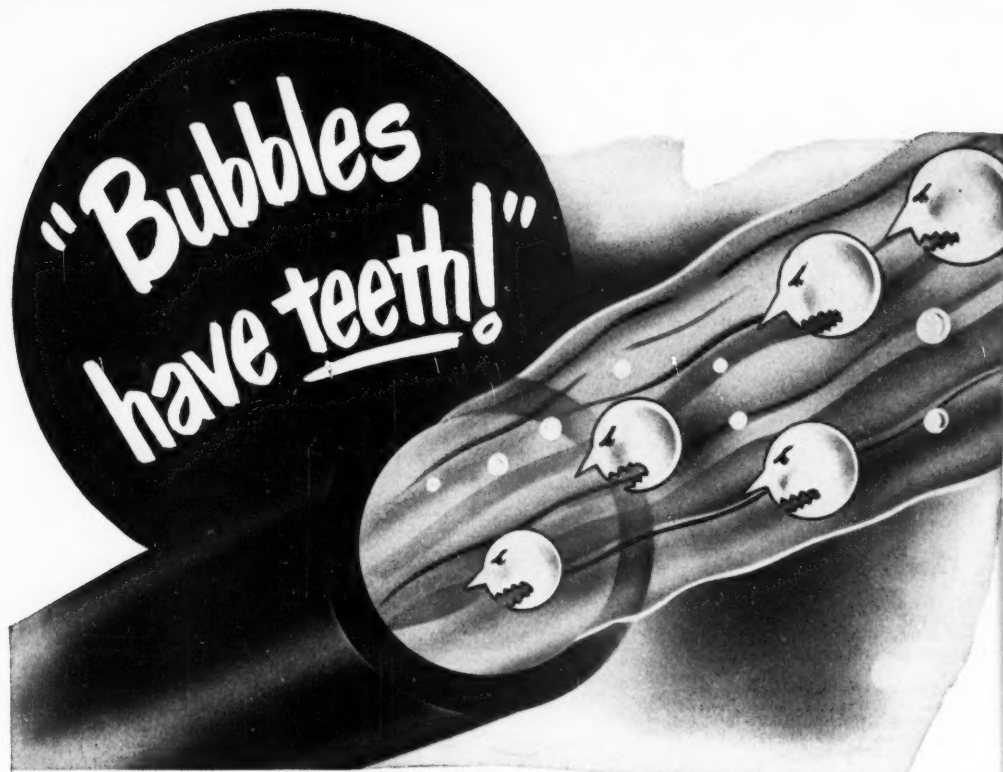
FERTILIZERS +12 1/2 %



Source: U.S. Dept. of Agriculture

'53 Fertilizer

Supply of fertilizer materials is going to be up 12.5 percent for the 1952-1953 crop year. Total supply will come to 5,900 thousand tons compared with 5,245 thousand for the 1951-1952 crop year. Availability of phosphates is placed at 2,465 thousand tons, an increase of 10.3 percent over the preceding crop year. Potash supply is making the biggest gain, percentage-wise, up 16.7 percent. The supply is forecast as 1,850 thousand tons. Supply of nitrogen is expected to be up by 11.2 percent to 1,585 thousand tons.



QUITE a number of years ago Revere coined the phrase "Bubbles have teeth." This refers to the fact that what is called air entrainment is highly damaging to condenser tubes. Bubbles carried along with the cooling water set up a strong disturbance in it, disrupting the film that should protect the metal, and actually seeming to eat away the tube. The oxygen contained in the air bubbles also is destructive. Fortunately, the effects of air entrainment on condenser tubes are sufficiently distinctive to permit Revere Research to detect the trouble by examination of short lengths cut from tubes that have failed before their time.

Thus it happens that every once in a while the Research Department in Rome, New York, working through the Technical Advisory Service, is able to say that there is air leaking into a condenser it has never seen, in a far-off state. The problem then is to seal the water system against the entrance of air. This is not always an easy task, and it is one that the Revere Technical Advisory Service is glad to tackle together with the customer if asked to do so. After all, we want our condenser tubes to last as long as possible; that's what makes customers happy, and builds and preserves our reputation as producers of fine tubes.

In one such instance of bubble trouble, the operator, a public utility, could find no visible sign of a leak. Checking and tightening every bolt and seal produced no results. Finally it was decided to put plate glass windows in some of the inspection plates, in order to see what was going on inside. This located the defect, a stream of bubbles being easily seen pouring out of a gasket. The water was flowing past that gasket with sufficient velocity to suck air in.

In another instance, a few samples of failed tubes from an oil refinery (located almost 3,000 miles away from the utility) were sent to Revere's Research Department. The refiner was told that his trouble was due to bubbles. Again, a check of the condenser showed nothing. The water inlet and outlet lines and all gaskets and bolts seemed to be perfectly tight. Here was another puzzler. But once again it seemed plausible to assume that air was being drawn in where water velocity was high enough to create a suction. The search finally went all the way back to the water pumping station, where two cracked castings were located. Air sucked in through two tiny cracks was enough to do a lot of damage; bubbles do indeed have teeth.

Revere will gladly consult with you concerning condenser tubes, their selection, specification, and conditions of use. For condenser tubes and tube sheets in all the usual alloys, see Revere.

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New Construction

Proposed Work

Calif., Tracy—American Reinforced Paper Co., c/o Wm. A. Corlett, Archt., 347 Clay St., San Francisco, plans to construct a plant here. Estimated cost \$250,000

Ill., Chicago—CenCo Corp., 1700 W. Irving Blvd., plans to construct a laboratory. Childs & Smith, 20 N. Wacker Dr., Archts. Estimated cost \$100,000

Me., Rumford—Oxford Paper Co., Rumford, plans to construct a 5 story bleachery. Engineering Services, Inc., 844 Stevens Ave., Portland, Consult. Engr. Estimated cost \$500,000

Mass., Boston—General Fireproofing Co., Dennick Ave., E., Youngstown, O., plans to construct a warehouse on Commonwealth Ave. Perry-Shaw & Hepburn, Kehoe & Dean, 31 St. James Ave., Boston, Archts. Estimated cost \$100,000

Pa., Pittsburgh—Pennsylvania Paper Stock Co., 516 First Ave., plans to alter its warehouse. Paul Schell, 1112 Clark Bldg., Archt. Estimated cost \$350,000

Pa., Springdale—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, plans to construct a research laboratory. Hoffman & Crumpton, Century Bldg., Pittsburgh, Archts. Estimated cost \$300,000

Tex., Corpus Christi—Pontiac Refining Corp., 3400 Lawrence Dr., plans to improve and enlarge its refinery. Estimated cost \$300,000

Tex., Hawkins—Natural Gasoline Co., Hawkins, plans to construct an addition to its plant. Estimated cost \$300,000

Tex., Houston—Diamond Alkali Co., 1006 Main St., plans to construct a chlorine plant. Estimated cost \$8,750,000

Tex., Houston—Eastern States Petroleum Co., Inc., 8938 Manchester Ave., plans to re-construct tower at Plant No. 1. Estimated cost \$100,000

Tex., Houston—Koller Chemical Works, Div. of Diamond Alkali Co., Houston Ship Channel, plans to construct plant for the manufacture of "Lindane" an insecticide. Estimated cost \$1,000,000

Tex., Houston—Phillips Chemical Co., City Natl. Bank Bldg., plans to construct a phosphatic fertilizer plant. Estimated cost \$3,086,050

Contracts Awarded

Ala., Birmingham—Southern Research Institute, 917 S. 26th St., has awarded the contract for addition to Ingall Laboratory to J. F. Holley, 905 6th Ave., N. Estimated cost \$142,600

Calif., San Leandro—Western Waxed Paper Plant, Div. of Crown-Zellerbach Corp., San Leandro, has awarded the contract for a plant addition to Christensen & Lyons, 3454 Hariem St., Oakland. Estimated cost \$350,000

	Current Projects		Cumulative 1952	
	Proposed Work	Contracts	Proposed Work	Contracts
New England.....	\$600,000		\$7,600,000	\$3,659,000
Middle Atlantic.....	650,000	\$500,000	44,100,000	56,635,000
South.....	1,517,000		380,045,000	220,771,000
Middle West.....	100,000	10,575,000	63,930,000	131,845,000
West of Mississippi.....	15,347,000	6,129,000	603,983,000	390,945,000
Far West.....	250,000	350,000	128,915,000	33,188,000
Canada.....			162,833,000	48,388,000
Total.....	\$16,947,000	\$19,071,000	\$1,201,426,000	\$885,431,000

Fla., Coral Gables—International Petroleum Co., 396 Alhambra Circle, has awarded the contract for a warehouse and office addition to Porter-Wagor, Russell, Inc., 132 Aragon Way. Estimated cost \$100,000

Ill., Chicago—Chicago Molded Products Corp., 1020 N. Kalmer Ave., manufacturer of plastic products, has awarded the contract for a factory addition to J. Emil Anderson & Son, 1809 Balmoral Ave. Estimated cost \$225,000

Ill., Kankakee—The Simoniz Co., 2100 S. Indiana Ave., Chicago, manufacturer of auto polishes, has awarded the contract for a factory to J. Emil Anderson & Son, 1809 Balmoral Ave., Chicago. Estimated cost \$900,000

Ill., Mokena—Carter Products Co., Mokena, manufacturer of plastic pipe and tubing, has awarded the contract for a factory to J. Emil Anderson & Son, 1809 Balmoral Ave., Chicago. Estimated cost \$300,000

Ill., North Chicago—Abbott Laboratories, 14th and Sheridan Sts., has awarded the contract for a warehouse to Carroll Construction Co., 333 N. Michigan Ave., Chicago. Estimated cost \$3,000,000

Ill., Robinson—Ohio Oil Co., 539 S. Main St., Findlay, O., has awarded the contract for a refinery addition to Houdry Process Corp., 225 S. 15th St., Philadelphia, Pa. Estimated cost \$5,000,000

Ind., Valparaiso—Continental Diamond Fibre Co., Valparaiso, has awarded the contract for a factory addition to Smith Nuppen Co., 360 Indiana Ave. Estimated cost \$300,000

La., Baton Rouge—Ethyl Corp., North Baton Rouge, has awarded the contract for plant additions to Perilliat-Rickey Construction Co., P. O. Box 7027, New Orleans. Estimated cost \$524,000

Md., Baltimore—Davison Chemical Corp., Davison Bldg., has awarded the contract for a warehouse on Chemical Rd., to Consolidated Engineering Co., 20 E. Franklin St. Estimated cost \$250,000

Mich., Bay City—Dow Chemical Co., 932 Fisher Bldg., Detroit, has awarded the contract for a foundry addition to The Austin Co., 227 Curtis Bldg., Detroit. Estimated cost \$600,000

Minn., Riverton—Manganese Chemicals Corp., K. Leute, Rand Tower, Minneapolis, has awarded the contract for a manganese plant here to McDonald Construction Co., Brainerd, Minn. Estimated cost \$1,500,000

Mo., St. Louis—Johnston Foil Manufacturing Co., 6106 S. Bway, has awarded the contract for a 1 story, 39x260 ft. warehouse addition to Geo. L. Cousins Contracting Co., 875 N. Skinner Blvd.

Nebr., Omaha—Farm Fertilizers, Inc., Bellevue and Chandler Rds., has awarded the contract for a plant addition to Foster-Smetana Co., 4360 Nicholas St., at \$109,657

O., Youngstown—Burdett Oxygen Co., 340 Lakeside Ave., Cleveland, has awarded the contract for a plant for the manufacture of oxygen, nitrogen and argon, to Emanuel Katzman & Co., 116 Linden Ave. Estimated cost \$250,000

Pa., Philadelphia—E. I. du Pont de Nemours & Co., Inc., Nemours Bldg., Wilmington, Del., has awarded the contract for a re-packaging warehouse to George R. Heebner, Inc., 1241 Vine St. Estimated cost \$250,000

Tex., Austin—Jefferson Chemical Co. of New York, Dallas Hy., has awarded the contract for a 2 story laboratory and facilities to Leslie F. Crockett Construction Co., Box 4036, at \$136,190

Tex., Corpus Christi—Great Southern Chemical Co., Robstown Rd., will construct a benzene and toluene plant or butylene concentrates plant with own forces. Estimated cost \$2,902,105

Tex., Deer Park—Diamond Alkali Co., 1006 Main St., Houston, has awarded the contract for a laboratory to Marshall Construction Co., 400 Center St., at \$89,190

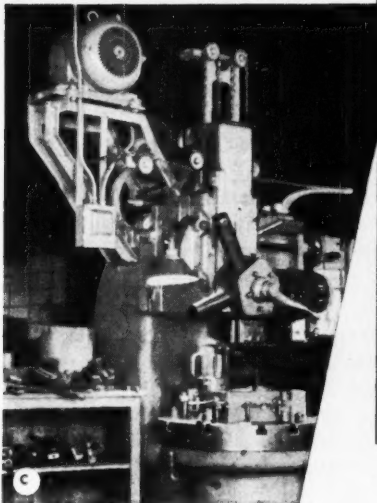
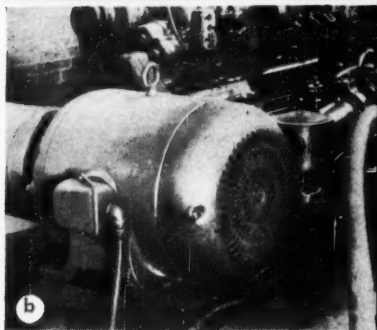
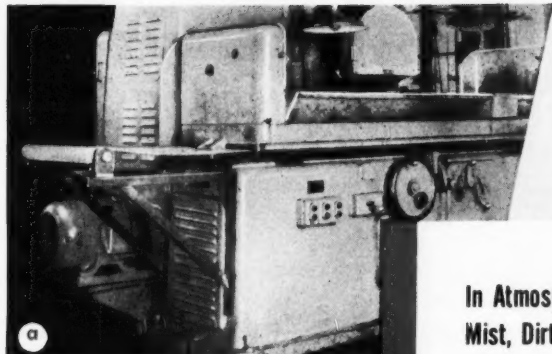
Tex., Etter—Kerr-McGee Co., Kerr-McGee Bldg., Oklahoma City, Okla., has awarded the contract for a natural gas plant to Dresser Engineering Co., Masonic Bldg., Tulsa. Estimated cost \$850,000

Tex., Goldsmith—Gulf Oil Corp., Production Div., Fort Worth, will construct a field pumping station with own forces. Estimated cost \$175,000

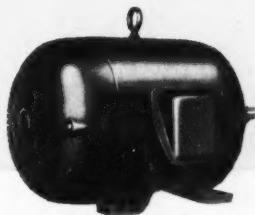
Tex., Hendricks—Gulf Oil Corp., Production Div., Fort Worth, will construct a field pumping station with own forces. Estimated cost \$200,000

Tex., Houston—T. Wayne Price Construction Co., Littlefield Bldg., Austin, will construct a laboratory with own forces. Estimated cost \$85,000

Va., Sunbright—Foot Mineral Co. c/o Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa., contractor will construct a chemical plant. Estimated cost will exceed \$750,000



- (a) Surface grinder with Century 5 horsepower TEFC motor mounted near the floor.
- (b) Century 15 horsepower TEFC motor operates in coolant fog from this grinder.
- (c) Boring Mill with Century 5 horsepower TEFC motor.



In Atmospheres Containing Dust,
Mist, Dirt, Fog... Protect the Power
that Drives Your Production Machines

... Use *Century*

Totally Enclosed Fan Cooled Motors

In locations where the air is charged with substantial quantities of metallic or abrasive dusts, coolant mists or fog, or oil-laden factory dusts, Century Type TEFC Motors assure protection to help maintain uninterrupted production.

Because the vital parts of the motor are sealed in an inner frame, they are isolated from the outside atmosphere. A large fan blows cooling air between the inner and outer frames — keeps the motor temperature well within safe limits.

Wherever there are adverse atmospheric conditions, specify Century Totally Enclosed Fan Cooled motors, to give you the extra assurance that production will be maintained.

Other types and kinds of Century motors are built in sizes from $\frac{1}{8}$ to 400 horsepower — designed to meet all popular industrial requirements.

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ALTERNATING CURRENT MOTORS POLYPHASE

Squirrel Cage Induction— $\frac{1}{8}$ to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
Synchronous Motors—20 to 150 H.P.

SINGLE PHASE

Split Phase Induction— $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ H.P.
Capacitor— $\frac{1}{8}$ to 20 H.P.
Repulsion Start, Brush Lifting, Induction— $\frac{1}{8}$ to 20 H.P.

DIRECT CURRENT MOTORS

$\frac{1}{8}$ to 300 H.P.

GENERATORS

AC, .63 to 250 KVA
DC, .75 to 200 KW

GEAR MOTORS

$\frac{1}{8}$ to $1\frac{1}{2}$ H.P.

MOTOR GENERATOR SETS

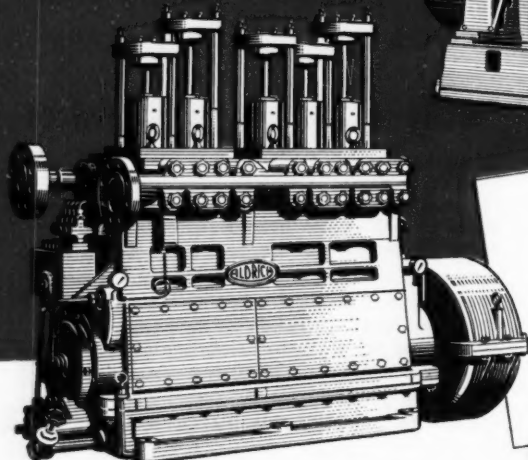
AC to DC, AC to AC
DC to DC, DC to AC

Open Protected, Splash Proof, Totally Enclosed Fan Cooled, Explosion Proof.

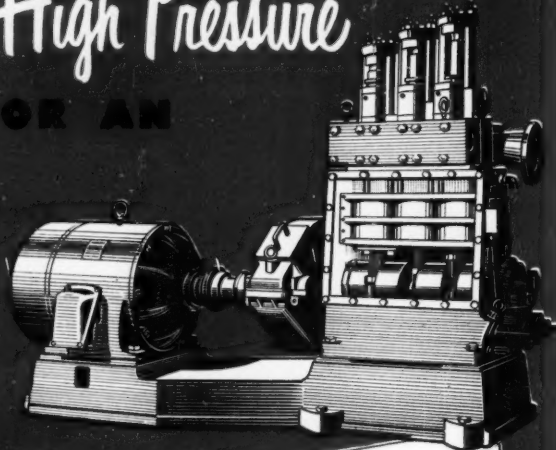
CE-748

High Viscosity-High Pressure

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*Aldrich Direct Flow
Triplex and
Quintuplex Pumps*



APPLICATIONS

Among many liquids handled by Aldrich Pumps are: caustic solutions, fatty acids, nitric acid, acetic acid, aqua ammonia, anhydrous ammonia, as well as liquids encountered in the petroleum refining, petro-chemical, and other industries.

From our service files we can frequently make specific recommendations to meet your chemical pumping needs . . . whether they involve corrosion, high viscosity or high pressure.

Many of your requirements can be met by an Aldrich Direct Flow Pump . . . a unit featuring advantages such as: high volumetric efficiency; sectionalized fluid-end; interchangeable wearing parts (among 3-, 5-, 7-, and 9-plunger pumps);

changeable plunger sizes, and higher operating speeds which result in more work from a smaller, more compact pump.

Aldrich Direct Flow Pumps are made in 3", 5" and 6" stroke sizes. They range up to 900 hp, 7500 psi. To regulate capacity, units can be furnished with an Aldrich automatic by-pass valve control system which operates with all types of accumulators. Write for Data Sheet 64 Series.

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30 GORDON STREET • ALLENTOWN, PENNSYLVANIA

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Direct Flow Pump*

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U.S.I. CHEMICAL NEWS

October

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries

★ 1952

ATTENTION

Users of Taxfree and Specially Denatured Alcohol

Now is the time for users of specially denatured alcohol to renew their basic permit (Treasury Department Form 1479) for 1953. It is also time for users of Taxfree alcohol to complete and file with the District Supervisor—Alcohol Tax Unit—their application (Form 1450) for renewal of their Taxfree Alcohol permit for 1953. If you require forms or any assistance in their preparation, please call your nearest U.S.I. office.

Handy Cross Reference For Govt. Spec. Colors Available from U.S.I.

U.S.I. recently made available, as an added service to paint manufacturers, a handy bulletin of cross references for the color designations contained in Federal Specification TT-C-595. This specification, entitled "Color Card Manual for Ready-Mixed Paints", is available from the Superintendent of Documents, Washington, D. C., for \$4.50 per copy. Issued in January, 1950, as part of the Armed Forces unification program, it combines all equivalent government agency paint colors under a single new number and gives a color chip for each. The old numbers which have been replaced are not listed, however, U.S.I.'s new cross reference sheets fill in this gap and make the job of interpreting the new federal designations much easier. The sheets list all of the new colors by name and number, and give the former Army 3-1 Parallel, ANA Parallel, AN Camouflage Parallel, or other number, for each. Interested persons who have not already received copies of the bulletin may obtain them by writing their nearest U.S.I. sales division office.

Atomic Analytical Service Now Available to Industry

Industrial, scientific, and medical organizations were recently offered the service of what is described as a new and highly accurate method of using atomic energy to detect and measure impurities. Applicable to foods, pharmaceuticals, metals, and other materials, the new analytical technique involves exposing the test sample to neutron bombardment in a graphite reactor or "atomic furnace". Traces of impurities in the material are thus made artificially radioactive and their exact quantities can then be measured with highly sensitive instruments and detectors specially developed for atomic energy use. The method is claimed to be capable of detecting and measuring trace elements too slight to be determined by other chemical or physical means. It is also reported to be more specific than other techniques because the isotopes produced have individual characteristics as to modes of decay and types of radiation. These characteristics are never duplicated exactly in any other isotope, it is said.

U.S.I. Anti-Freezes Offer Motorists Complete Freedom From Cold-Weather Worries

U.S.I.'s Permanent and Super Pyro Anti-Freezes Give Sub-Zero Protection and Prevent Corrosion In All Cooling Systems; Car Owners Should Act Now

October is the time when the automobile owner's anti-freeze problems are getting to materialize unexpectedly on some cold morning. Wise motorists are getting ready this month for the freezing weather they know is coming instead of waiting for the first, and often costly, evidence of Old Man Winter's appearance.

Plastic Makes Better Casts For Fractured Bones

A new plastic powder, now available to hospitals and doctors, may entirely replace the cumbersome plaster of Paris bandages used to keep fractured bones immobile. It is reported. In use, one can of the powder, which is sufficient for one arm or leg cast, is dissolved in a pint of warm water, a catalyst added, and the bandages dipped and applied. Casts made with the new material are stronger than plaster and can be made up to two-thirds lighter in weight. Even though they are thinner, the casts provide adequate immobility and support within a few hours of application, it is claimed. Another advantage cited for the new material is that the casts produced with it are porous enough to permit evaporation of moisture from the skin. High water resistance is also a feature—casts can be soaked for several days without disintegrating, the manufacturer claims.

U.S.I. is again offering car owners complete coverage of all of their anti-freeze requirements with the two time-tested favorites, U.S.I. Permanent Anti-Freeze and Super Pyro Anti-Freeze. With automobiles more expensive than ever, the protection from cooling system troubles which these products give is more important than it has ever been. Realizing this, U.S.I. has made available this year, along with its famous anti-freeze products, data and information which will help dealers to serve their customers' cold-weather needs even more effectively.

Freeze-Proof, Boil-Proof, Rust-Proof

U.S.I. Permanent Anti-Freeze affords protection against freezing far down the sub-zero temperature scale, and being substantially boil-proof, it won't evaporate during warm spells. One filling lasts all winter. The product contains a carefully chosen combination of rust-inhibitors which guards against

MORE



A cooling reminder of what may be in store this winter. U.S.I. Permanent or Super Pyro Anti-Freeze in your radiator will help you avoid the leading role in a scene like this in the months ahead.

October

U.S.I. CHEMICAL NEWS

1952

CONTINUED

U.S.I. Anti-Freezes

corrosion in the automobile's cooling system. When used in accordance with instructions, U.S.I. Permanent Anti-Freeze is guaranteed to give satisfactory performance.

U.S.I.'s Super Pyro Anti-Freeze has been a preferred product with car owners since it was introduced in 1932 as the first premium anti-freeze concentrate scientifically compounded to do more than merely protect against freezing. Today's long-lasting, economical Super Pyro is 33½ per cent more



U.S.I.'s two anti-freeze products are available from service stations and auto supply stores throughout the country.

effective than most other types of anti-freeze. It protects all seven metals in the automobile cooling system against rust and is free from unpleasant fumes.

Research Assures Continuing Improvement

A special section of U.S.I.'s technical development laboratory at Baltimore is devoted to a constant search for improved anti-freezes. Tests are continually made to measure effects of anti-freezes on metals, rubber, finishes, and any other materials with which they may come in contact. The research laboratory compiles accurate data on freezing points, boiling points, toxicity, fire hazards, and thermal properties of anti-freeze products. Research also serves to keep U.S.I. abreast of any changes in design of automobile cooling systems which might mean the altering of anti-freeze properties or formulations.

Use of Acetyl Methionine Heals Severe Leg Ulcers

Two French doctors have reported successful topical use of the acetyl derivative of DL-methionine to heal varicose leg ulcers which did not respond to conventional methods of treatment. The doctors found that acetyl methionine gave equally good results when applied directly in the form of 10 per cent methionine powder on an excipient of talc, zinc oxide or lactose. Excellent healing was also obtained when a 20 per cent aqueous solution of the sodium derivative of acetyl methionine was applied directly to the leg ulcer. In no case was there evidence of sensitivity to the product, according to the report.

Lacquer Gives Plastics Sand Blasted Finish

A treatment designed to replace sand blasting to give acrylic plastic surfaces a frosted finish has been developed. The product used is a lacquer, believed to be the first inexpensive and simple method for producing a sand blasted finish on plastics without actually sand blasting them. The lacquer can be applied by brush, dip, or spray. It is said to dry in three to five minutes at room temperature to give a smooth coating which is less inclined to hold dirt than a true sand blasted finish. The degree of opacity is easily controlled by varying the amount of lacquer applied, and since it is a surface treatment, thin sheets can be used, it is claimed.

Thallium Recovery

Two methods for recovering thallium, a rare element of increasing industrial importance, were announced in a recent government report. Although thallium is widely distributed in nature, it occurs in such minute quantities that it can be recovered only as a by-product in processing ores of other metals, it is said. The methods described in the report deal with the recovery of thallium from white arsenic by a process of volatilization, and from lead smelter flue dust by cyclic leaching.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U. S. I.

To protect chrome plate, even when it has no underlying coat of nickel, a clear synthetic enamel is available which is claimed to have withstood laboratory salt spray and humidity tests for as long as a year. (No. 851)

A new plastic spray for windows of homes, offices, boats, and aircraft, provides a blue-green tint which cuts down glare and reduces heat from the sun, according to the manufacturer. (No. 852)

To waterproof fabrics without closing their weave, a silicone-type water repellent is on the market in an aerosol "bomb" container. Also applicable to rugs, upholstery, etc., the spray does not affect colors or stiffen the material, it is claimed. (No. 853)

An easily applied luminous paint, recently made available, is suggested for use on door knobs, house numbers, steps, switch plates, fishing plugs, and other places. (No. 854)

Screws can be held tightly in plasterboard, brick, wood, tile, etc., it is claimed, with new plastic plugs which, when driven into drilled holes, expand when screws are inserted. The plugs allow withdrawal and firm reseating of the screws. (No. 855)

To protect hands when inserting glass tubes and thermometers into stoppers, a neoprene manipulator has been marketed which eliminates the hazard of breakage and can be used with even irregular shaped tubing. (No. 856)

A new enamel for weather- and rust-proofing wire screens can be brushed or rolled on, does not clog the wire mesh, and dries to a fine luster in a few hours, the manufacturer states. (No. 857)

New chemically resistant diaphragm valves, claimed to be tough, odorless, tasteless, and nontoxic, can be used for handling many food products and corrosive chemicals, and can be serviced without removing from the line. (No. 858)

A new water demineralizer for small quantity users fits the water tap and utilizes a replaceable plastic cartridge of exchange resins which change color when exhausted. Reduction of dissolved salts to less than 0.1 ppm is claimed. (No. 859)

A new transparent, odorless, wax-type cutting oil for machine tool use is said to reduce smoking, to permit increased feeds, and to be free of all chemically active additives such as chlorine and sulfur compounds. (No. 860)

PRODUCTS OF U. S. I.

ALCOHOLS

Amyl Alcohol (Isoamyl Alcohol)
Butanol (Normal-Butyl Alcohol)
Fusel Oil—Refined
Propanol (Normal-Propyl Alcohol)

Ethanol (Ethyl Alcohol)

Specially Denatured—all regular and anhydrous formulas
Completely Denatured—all regular and anhydrous formulas
Pure—190 proof U.S.P., Absolute—200 Proof
Solox—proprietary solvent—regular and anhydrous

ANTI-FREEZE

Super Pyro® Anti-Freeze
U.S.I. Permanent Anti-Freeze

ETHERS

Ethyl Ether, U.S.P.,
Ethyl Ether, Absolute—A.C.S.

ACETONE—A.C.S.

ANOLS

Ansol® M
Ansol® PR

ACETIC ESTERS

Amyl Acetate—Commercial and High Test
Butyl Acetate
Ethyl Acetate—all grades
Normal-Propyl Acetate

OXALIC ESTERS

Dibutyl Oxalate
Diethyl Oxalate

PHTHALIC ESTERS

Diethyl Phthalate
Dibutyl Phthalate
Diethyl Phthalate

OTHER ESTERS

Diatol®
Diethyl Carbenate
Ethyl Chloroformate

RESINS (Synthetic and Natural)

Arochem®—modified types
Arodure®—urea-formaldehyde resins
Aroflex®—pure phenolics
Aroflat®—for special flat finishes
Aroflint®—room temperature curing phenolic
Aroplax®—alkyds and allied materials
Aroplast®—copolymer modified alkyds
Ester Gums—all types
Natural Resins—all standard grades

INSECTICIDE MATERIALS

CPR Concentrates: Liquid & Dust
Piperonyl Butoxide
Piperonyl Cyclohexene
Pyranone® Concentrates: Liquid & Dust
Pyrethrum Products: Liquid & Dust
Rotenone Products: Liquid & Dust

INSECTIFUGE MATERIALS

Indalone®
Triple-Mix Repellents

INTERMEDIATES

Acetacetanilide
Acetacetartha-chloroanilide
Acetacetartha-ortho-iodide
Acetacetartha-chloroanilide
Ethyl Acetoacetate
Ethyl Benzoylacetate
Ethyl Sodium Oxalacetate

FEED PRODUCTS

Calcium Pantothenate (Feed Grade)
Curbay B-C®
DL-Methionine (Feed Grade)
Nicotin, U.S.P.
Riboflavin Concentrates
Special Liquid Curbay®
U.S.I. Vitamin B₁₂ and
Antibiotic Feed Supplements
Vactone® 40

OTHER PRODUCTS

Pib®—Liquid Insulation
Special Chemicals and Solvents
Urethan, U.S.P.
Acetoldehyde
Propionic Acid
Collodions
Ethylene
Methionine
(Pharm. Grade)
Nitracellulose solns.
Propionic Acid

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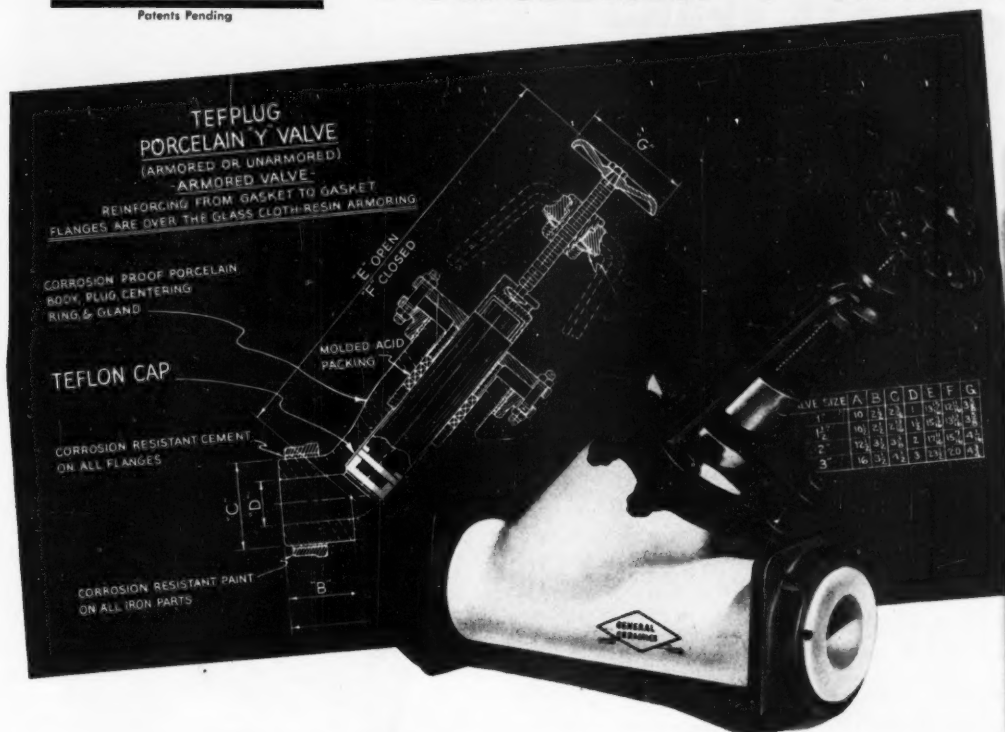
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ABSOLUTELY NEW!

Solve your 3 major valve problems . . .

"TEFPLUG" PORCELAIN Y VALVE

Patents Pending



LAPPING COMPLETELY ABOLISHED! No more fractured bodies from closing valves too tight! Quick, easy, fingertouch adjustment! You're assured these three big advantages with the radically new "Tefplug" Porcelain Y Valve. Special spring washers put a safe limit to pressure on the porcelain seat. The unique pliable "Tefplug," machined of Du Pont Teflon, further reduces strain and affords improved seating. This cushion action also makes it ideal for use with automatic or remote operating mechanisms.

The body of the new "Tefplug" Valve is made of our thermal shock resistant Pyrotherm porcelain

which has been thoroughly proved in years of service. The valve is now available in sizes from 1/2" to 6", both in Y and angle valve constructions. . . with or without our Polyiron armoring. . . and with the choice of standard blue asbestos, Teflon impregnated blue asbestos, or the new "Chemlon" Teflon ring packing.

Here's the most important advance in porcelain valve design that has been made in a score of years. Write today for the full story about the "Tefplug" valve, or call our nearest sales office General Ceramics & Steatite Corp., Chemical Equipment Division, Keasbey, New Jersey

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**TROUBLE FREE
FOR 15 YEARS**

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muriatic acid!**

*Another
'open and closed'
case for*

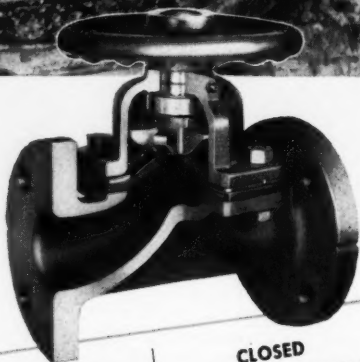
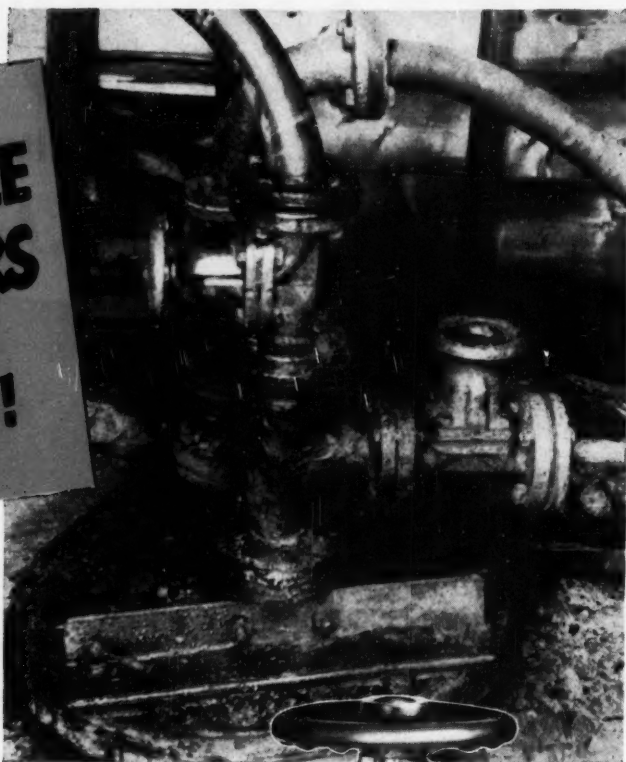
GRINNELL-SAUNDERS DIAPHRAGM VALVES

In 1936, a Canadian mine installed Saunders Diaphragm Valves with rubber linings on the feed and drain piping of an underground tank used for the storage of muriatic acid. Today, after 15 years, those same valves are in use—having required no maintenance except for periodic replacement of diaphragms, a simple operation done without removing the valve from the line.

Grinnell-Saunders Diaphragm Valves are available in many different combinations. Bodies are made in a variety of metals—iron, stainless steel, bronze, aluminum and others. *But of more importance* is the fact that a body of cast iron (a metal not in short supply) can be lined with glass, lead, natural rubber, neoprene and other materials which, in many instances, handle corrosive fluids *better* than metals.

Diaphragms come in natural rubber, neoprene, butyl, hycar, a special synthetic for foods and KEL-F. This last is chemically inert to all acids and alkalis in all concentrations with the exception of molten alkali metals.

From this broad selection of materials, the problems which the Grinnell-Saunders valve can solve are extremely varied. No wonder industry after industry is putting it on the line.



OPEN



No packing glands to demand attention. Working parts isolated from fluid... sticking, clogging, contamination, corrosion eliminated.

CLOSED



Compressor or finger plate supports the diaphragm in all positions. No metal-to-metal seats to become damaged or wire-drawn.

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WHENEVER PIPING IS INVOLVED



Grinnell Company, Inc., Providence, Rhode Island

Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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★ Dustless Dry Grinding! ★ Non-Clog Wet Grinding!

For Finenesses
of 100
to 325 Mesh



WILLIAMS HELIX-SEAL HAMMER MILLS

**Combining All The Advantages Of An
Efficient Hammer Mill With A Closed-Circuit
Screw Type Feed**

Cleaner, Safer Dustless Dry Grinding

The closed screw feed prevents the uncontrolled inrush of air into the mill and assures cleaner operation, guards against health, fire or explosion hazards, and greatly reduces housekeeping expense.

Non-Clogging, Accurate Wet Grinding

The reduction and sizing of sticky, wet or oily products is efficiently controlled by the screw feeder. Materials will not clog or ball up the mechanism.

No Separators, Fans Or Cyclones

Ground materials are discharged completely pulverized without tailings or oversize products to be separated. Collectors, fans or separators are entirely unnecessary.

Inexpensive, Easy Installation

The small floor space, the elimination of vibration, and the need for only a simple sealed bin or chute, keeps the easy installation of a Helix-Seal Mill very economical. No costly, cumbersome equipment is required.

Low-Cost Maintenance

The interior of a Helix-Seal Mill is completely accessible for fast, easy cleaning, by quick brushing for most materials. Extra rugged construction and simple design promise the very minimum in upkeep and service.

Ask For Brochure

WILLIAMS

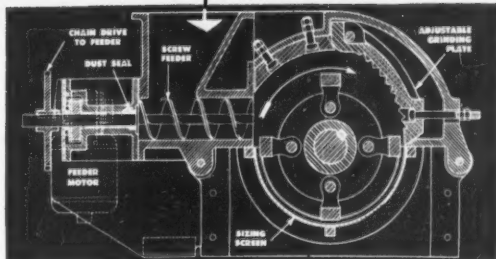
CRUSHERS

GRINDERS

SHREDDERS

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

Cross section of Helix-Seal Mill showing long grinding plate over which material must pass before falling to sizing screen. Grinding plate is adjustable to compensate for wear.



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HAMMER MILLS in many types and sizes for any requirement . . . ROLLER and IMPACT MILLS for fine grinding, even to micron sizes . . . DRYER MILLS for grinding wet materials down to 400 mesh . . . AIR SEPARATORS . . . VIBRATING SCREENS . . . COMPLETE PLANTS for installation in existing buildings.

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BLANKETS... Metal-reinforced, flexible, felted, black rockwool insulation

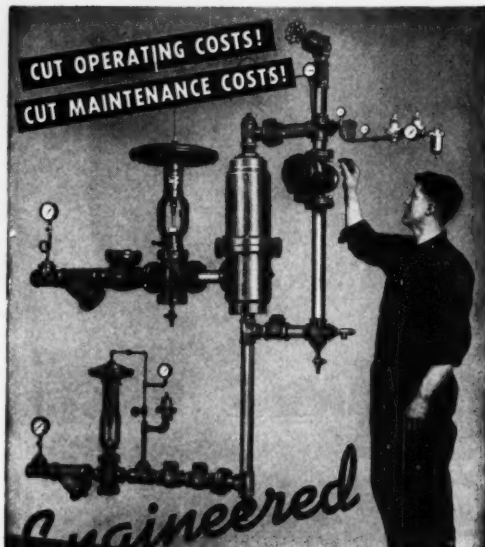
☐ **NO. 1 INSULATING CEMENT...** All-purpose, rust-inhibiting, plastic cement

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Pick INSTANTANEOUS
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Engineered
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AT THE TEMPERATURE REQUIRED!

Here's the money-saving answer to hot water required for industrial needs. **PICK Heaters** provide hot water instantly — by steam injection. They're entirely automatic to provide

and accurately maintain temperatures up to 180° F. The exclusive **Pressurizer Piston** stabilizes injection pressure — eliminates pipe hammering and shaking. Available in seven sizes with rated capacities of 10 to 200 gallons per minute. Greater volumes can be obtained by multiple installations. Installation is simple, requiring only ordinary pipe connections.

Write for Engineering Details
and Specifications Write Dept. CE-8.

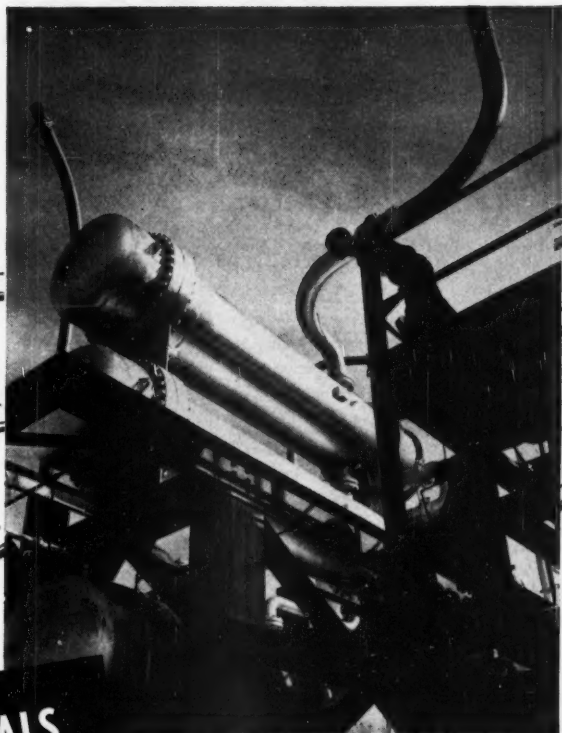
NO STORAGE TANKS NEEDED
Compact design permits installation in corners, on walls or overhead.

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*Typical refinery heat exchanger tubed
with ELECTRUNITE Pressure Tubes.*



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Run through a list of the scores of different petrochemicals . . . count off the leading producers . . . you'll have lists that include hundreds of large installations and important users of Republic ELECTRUNITE Heat Exchanger, Condenser and Boiler Tubes.

The ELECTRUNITE process assures users that Republic's Pressure Tubes are top-quality inside and out . . . that tubes are uniform in wall thickness, roundness, and ductility. They

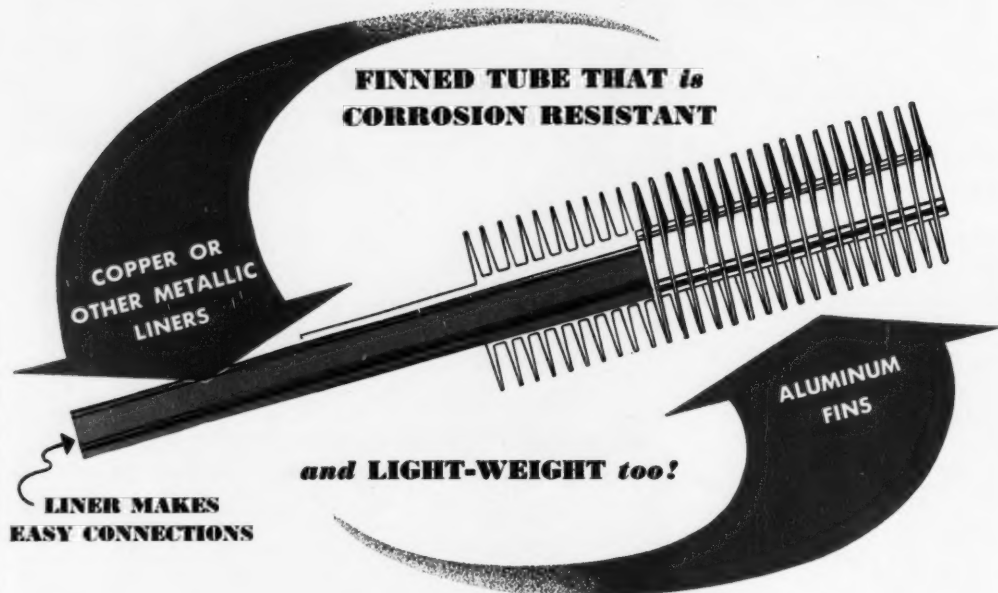
are uniformly corrosion-resistant throughout the metal and full normalizing assures easier rolling-in properties in every length.

Let us tell you more about these pressure tubes that bend right, roll-in tight, stand up better wherever carbon or stainless steel tubes are specified.

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AVAILABLE NOW...



Wolverine Trufin* in *bi-metal* was developed to meet customer demand for a more effective heat transfer application than could previously be obtained with applied fin tubes. After years of research and experimentation, Wolverine product engineers came up with an ideal development: *An economical finned tube—incorporating integral aluminum finned tube and liners of copper or copper base alloys.*** The integral finned tube and liner are joined mechanically. This rugged construction is capable of withstanding extreme temperatures and vibration.

Actual applications have revealed that the heat transfer efficiency of Trufin is sometimes *nine times* that of plain tube! In many instances the use of Wolverine Trufin has resulted in low-cost installation and maintenance with maximum heat transfer efficiency.

Trufin in *bi-metal* is tough; it's durable and is as easy to fabricate as plain tube! Liners of Trufin *bi-metal* are extended to permit easy installation.

Wolverine Trufin in *bi-metal* is available in many sizes and fin spacings.

Send for your copy of Wolverine's illustrated Trufin brochure. **WOLVERINE TUBE DIVISION**, Calumet and Hecla Consolidated Copper Company, Inc., *Manufacturers of tubing exclusively*. 1427 Central Avenue, Detroit 9, Michigan.

Wolverine also manufactures plain condenser tube in copper and copper base alloys.

*REG. U. S. PAT. OFF.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

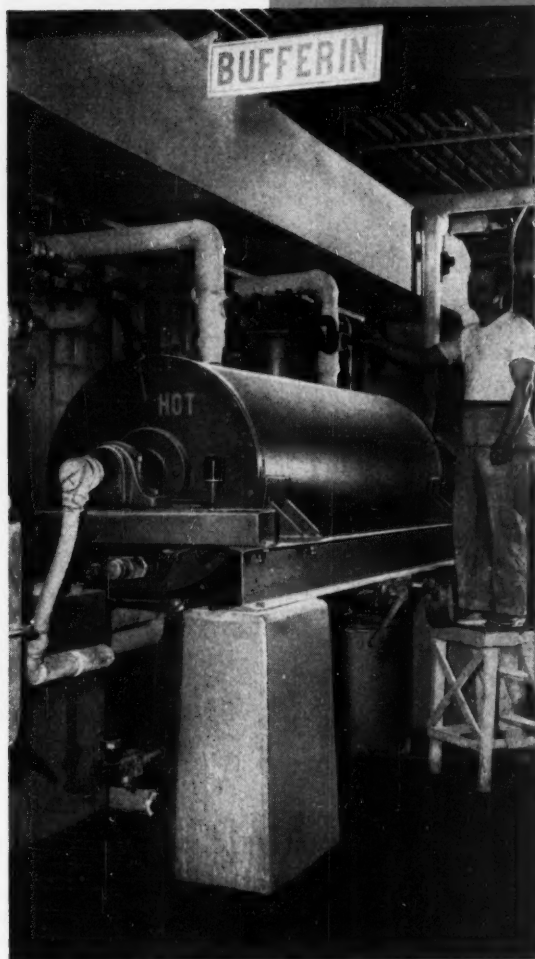
**Liners of steel and its alloys are also available.



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Dry in Vacuum ... reduce time and labor by 50%



Stokes Rotary Vacuum Dryer in operation at Bristol-Myers Company, Hillside, N. J.

Elimination of air is essential in the drying of many finely divided oxidizable materials. Drying in vacuum can often mean the difference between a profit or loss on a product . . . the difference between a fairly good and an excellent end-product.

Bristol-Myers Company, Hillside, N. J., uses a Stokes Rotary Vacuum Dryer in preparing the granulation for Bufferin tablets. Each particle of the material is exposed to a heated surface under vacuum at low temperature and thoroughly mixed by the dryer's agitator blades to insure uniform moisture elimination from the end-product. Result: a 50% reduction in time and labor as compared to a former process.

Fast, thorough, uniform, and economical drying of products in large batches with a minimum of labor is characteristic of Stokes Rotary Vacuum Dryers. They are designed for drying materials that may be tumbled, such as crystals, heat-sensitive chemicals and foods, metallic powders, and materials that otherwise would oxidize. Additional advantages include removal of water at temperatures as low as 100° F. and recovery of solvents up to 99%, or better.

Stokes Advisory Service and testing facilities are available on a confidential basis to manufacturers who can benefit from Stokes' years of experience in high vacuum drying, freeze-drying, evaporation, and impregnation.

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*Nothing takes the place
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National Lead Company's use of Glycerine for making synthetic resins dates back over 35 years. Today, Glycerine-derived alkyds play an important part in many of National Lead's familiar "Dutch Boy" paints. They're used in exterior finishes, such as quick-drying enamels for sash and trim, and also in enamels and flat paint for interior use.

FULLY ACCEPTED... FULLY AVAILABLE IN ALL GRADES!

For years, leading manufacturers of household and industrial finishes have favored Glycerine for making alkyd resins. Why? Because Glycerine-derived alkyds give them excellent package stability... improved water resistance... outstanding durability.

Glycerine-derived alkyds improve color retention and film toughness in air-drying coatings for metal equipment. They contribute flexibility and adhesion to baking finishes—where their compatibility with other resins like ureas and melamines is essential.

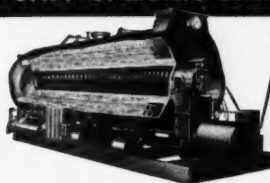
Glycerine is also preferred in resin-making because of its better cooking qualities. With Glycerine, manufacture of alkyd resins is easily controlled to give a product of low acid number, without undue hazard of gelation.

If you'd like detailed information on the chemical and physical properties of Glycerine, write for your copy of "Why Glycerine for Alkyd Resins and Ester Gums?"

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66%
MORE POWER
per sq. ft. of
heating surface

Cyclonic Combustion, the revolutionary new flame control used exclusively in Cyclotherm steam generators, reduces heating surface requirements from 5 to just 3 sq. ft. per B.H.P.—produces 66% more heating power per sq. ft.

Cyclonic Combustion controls flame characteristics in a revolving spiral vortex traveling the full length of the furnace to insure the maximum in heat transfer without direct flame impingement or hot spots. This high heat transfer rate enables Cyclotherm 2 pass generators to maintain a guaranteed minimum efficiency of 80% for any steam requirement—at a saving of up to 1/3 the space of conventional package steam generators.

Cyclotherm steam generators with patented Cyclonic Combustion offer these additional features: Full power operation from a cold start in 15 to 20 minutes. Savings up to 50% on maintenance. Greater fuel savings. Boilers designed for oil or gas operation from 18 to 500 h.p., 15 to 200 PSI operating pressure.

Find out how Cyclotherm will fill your steam requirements. Write today for free illustrated folder.



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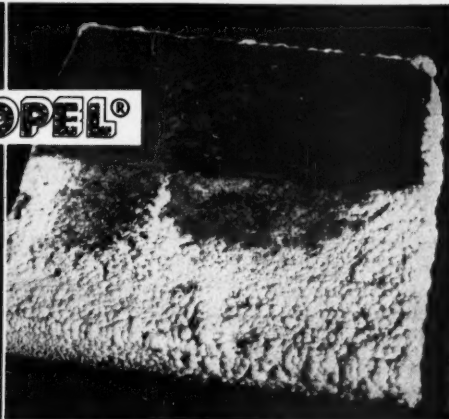
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THIS ACTUAL TEST
PROVES HOW

HYDROPEL®

PROTECTS
YOUR PLANT

The HYDROPEL (top half) part of this block absorbed little of the salt solution in which it was placed until all had evaporated. Air entrained concrete (lower half) sucked up the solution, leaving salt crystals throughout.



HYDROPEL is resistant to chemicals. Subjected to every known test for endurance, HYDROPEL concrete lasts longer because it resists moisture, impact, and chemicals (except acids).

HYDROPEL is a standard (integral) admix of the leading chemical firms. (Names furnished on request.) Many report HYDROPEL has increased concrete life four-fold.

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shows how HYDROPEL
performs under toughest
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Announcing Two New NONIONIC DETERGENTS

by the world's largest producer of synthetic detergent raw materials

After extensive laboratory and field tests, Oronite proudly introduces two outstanding nonionic detergents—Dispersant NI-W (water soluble) and Dispersant NI-O (oil soluble). Oronite offers both products in uniform quality, at stable prices and in assured supply.

Dispersant NI-W

(FORMERLY NI 8506)

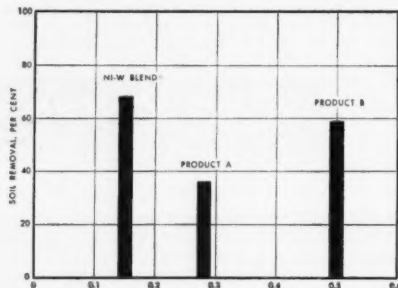
Oronite's new Dispersant NI-W is a clear, light straw-colored liquid—95% active. It may be compounded with phosphate or other builders and dried to give free-flowing granular products. It is also suitable for the making of liquid detergents. You will find NI-W very adaptable for the manufacture of economical, high-quality formulations. It is completely compatible with soaps and anionic detergents. As shown by the chart, unusual cotton detergency may be obtained. This new Oronite product is particularly suitable for manufacturing detergents for commercial or self-service laundries and automatic home washers. Technical bulletin describing Dispersant NI-W is available on request.

Dispersant NI-O

(FORMERLY NI 8503)

This new clear, straw-colored liquid detergent is an excellent emulsifier for water-in-oil emulsions. Dispersant NI-O was specially designed for use as a dry cleaning detergent in systems employing all types of solvents. It has the ability to suspend large quantities of finely divided solids in solvent media. It ex-

hibits superior detergency and is not readily absorbed by filter aids. Technical bulletin is available on request.



CONCENTRATION, PER CENT (300 ppm hard water)

*1% NI-W, 1% Alkylaryl Sulfonate, 50% Sodium Tripolyphosphate, 30% Sodium Sulfate

Cotton detergency in a tumbling type automatic washing machine of a formulation based on Dispersant NI-W compared to products A and B (commercial materials designed for this use). Note that each product was tested at the recommended use concentration and that the NI-W compound shows high soil removal performance at low concentration.

TESTS IN COMMERCIAL DRY CLEANING PLANT

	WOOLENS	
	DISPERSANT NI-O	Detergent A
Soil Removal Index*	99	91
Passup Rate**	70	55
	RAYONS	
	DISPERSANT NI-O	Detergent A
Soil Removal Index*	96	90
Passup Rate**	60	45

*Soil Removal Index determined by reflectance measurements of test swatches.

**Passup Rate is the percentage of garments not requiring spotting after cleaning.

A partial list of Oronite products:

Detergent Alkane, Detergent Slurry, Detergent D-40, Detergent D-60, Wetting Agents, Lubricating Oil Additives, Cresylic Acids, Gas Odorants, Sodium Sulfonates, Purified Sulfonate, Naphthenic Acids, Phthalic Anhydride, Ortho-Xylene, Para-Xylene, Xylol, Aliphatic Acid, Hydroformer Catalyst, Polybutenes.

ORONITE CHEMICAL COMPANY

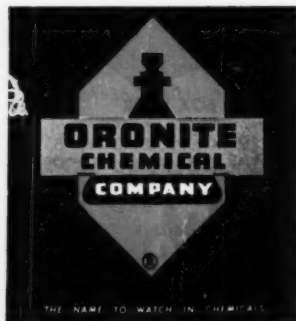
30 SANSOME STREET, SAN FRANCISCO 4, CALIF.

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traps help uncover hidden steam treasure



TRY A TRAP—FREE!

If you'd like to try a Yarway trap for 30 days in your own plant, send us a card. We'll send you the trap.



The facts are these:

A large southern chemical company about a year ago was up to capacity on their boilers. New process units were being added, requiring more steam—a new boiler seemed inevitable.

About that time they began replacing their old-type traps and bleed-off valves with Yarway Impulse Steam Traps and Strainers. Today, even with the new process units added, their daily steam consumption is nearly 100,000 lbs less than a year ago—the superintendent gives Yarway Impulse Traps credit for the saving.

Yarway Impulse Traps are *designed* to insure sending the most premium B.T.U.'s at top temperature into your product or process . . . to get equipment *hotter* sooner and *keep it hot!*

Yarway's have 11 other advantages, too—such as *small size*, *low maintenance*, *low cost*, and *availability* from over 200 Industrial Distributors.

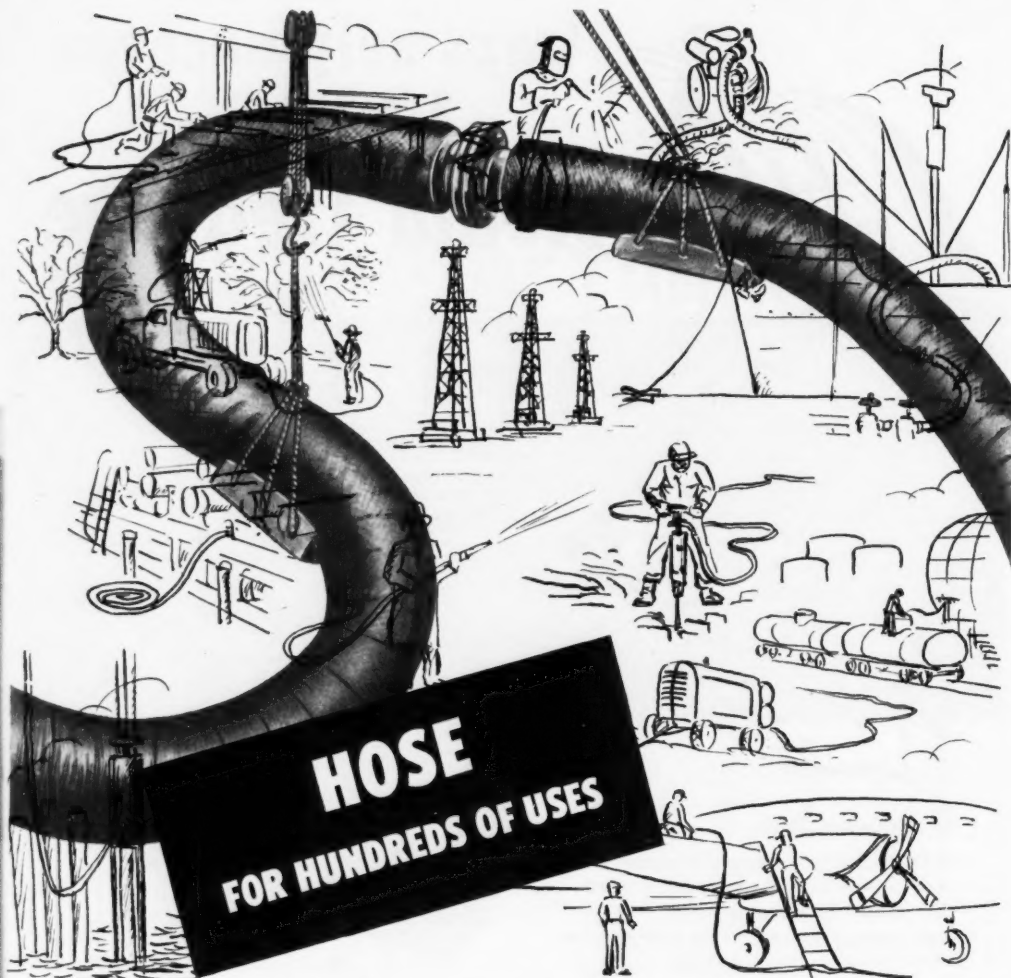
Write for Bulletin T-1740. Or for steam trap advice, call on your nearby Yarway service engineer.

YARNALL-WARING COMPANY

137 Mermaid Avenue, Philadelphia 18, Pa.



↓
the steam trap designed
with more production in mind



HOSE FOR HUNDREDS OF USES

The big hose shown here is suspended by booms and unloads petroleum from ship to shore. Whether your hose needs are standard or special, it's practically a certainty Raybestos-Manhattan engineers have already designed the right hose for you. R/M hose constructions range from as small as $\frac{1}{4}$ " paint spray hose to huge dredging hose big enough for a man to crawl through. The point is, you can't go anywhere to find better facilities or more experienced engineering to help you with a hose problem, than at Raybestos-Manhattan . . . and not only hose—it's true also of transmission, conveyor and V-belts . . . and all other products we make. Consult your R/M representative.



MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

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Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks
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BASIC FACTS, MAN-MADE MINERAL

K-423

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before deciding
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Electro-Carb (SILICON CARBIDE) **SPECIAL REFRACTORIES**

Because certain types of refractories have been used a long time IS a valid reason for investigating Electro-Carb at this time.

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Facts and figures in almost telegraphic brevity are contained in Bulletin B-749. Sent on company-letterhead request. If you have a problem concerning the use of silicon carbide refractories, please submit it at the same time.

**ACCURATE
PROCESS
CONTROL**
with *W&T*
**MERCHEN
FEEDERS**



W&T Merchen Scale Feeder

Successful process control — particularly in today's modern, high-speed plants — generally depends on the accurate feeding of dry, free-flowing, chemicals. Continuous, precision feeding — by weight — is essential to a uniform end product. And that's what W&T Merchen Scale Feeders can demonstrate in your plant, just as they are doing in hundreds of others.

Merchen Feeders are widely used both for the blending of several dry chemicals and for the addition of one or more dry chemicals to a liquid.

These feeders will handle from a few ounces to several thousand pounds per minute — and, of particular importance in many plants, they can be completely synchronized with other equipment, or equipped for remote or automatic control. For example, Merchen Feeders are equipped to stop automatically and at the same time stop all other synchronized process equipment if the delivery of material for any reason should vary from the rate of feed pre-set on the scale beam.

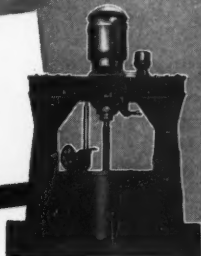
SERVICE — A nationwide service organization is prepared to suggest the proper W&T Merchen Feeders for your process and to give prompt service and installation supervision on Merchen Equipment.

Write today for additional information on W&T Merchen Scale Feeders.

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"CENTROID" SPEED CONTROL

assures correct speeds
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ONLY *Fletcher* has it!

The exclusive Centroid Speed Control developed by Fletcher lets the basket revolve at any desired speed for any length of time needed to discharge solids. This action is positive and speeds are constant. Thus, the operator is free to give undivided attention to handling the unloader. So, for greater safety and more efficient unloading . . . use the one centrifugal with the Centroid Control . . . get a Fletcher. Write for our Catalog for the Chemical Industry.

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Buy WILFLEY for cost saving performance

Companion to the famous WILFLEY Sand Pump

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- For more efficient performance...greater economy of operation...specify WILFLEY "AF" Acid Pumps. Dependable, trouble-free operation, on a round-the-clock schedule, with consequent stepped-up production and worthwhile power savings, are big reasons why modern chemical and processing plants all over the world now rely on WILFLEY Acid Pumps for handling acids, corrosives, hot liquids and mild abrasives.

- Available in 10- to 2,000-G.P.M. capacities, 15- to 150-ft. heads and higher. Wetted parts of practically all machineable alloys. Plastic lined models available. Every application individually engineered. Write or wire for details.

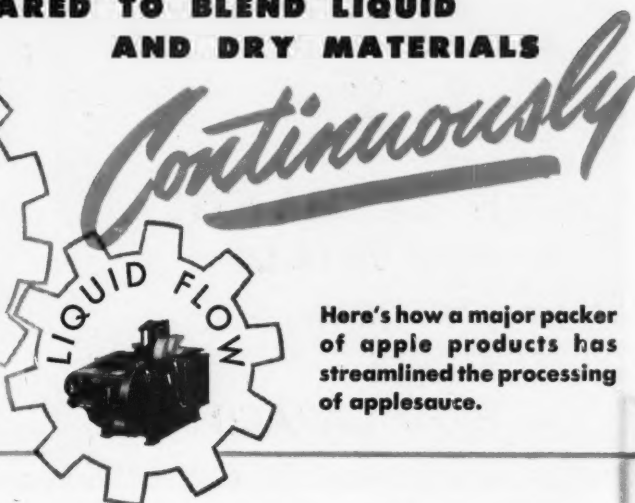
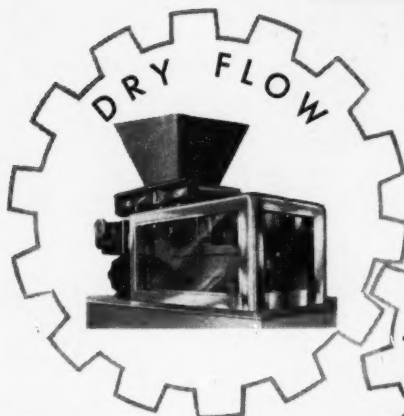


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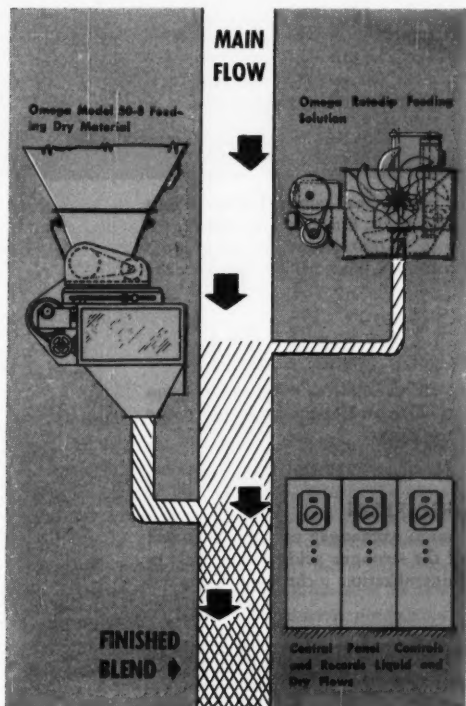
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New York Office: 1775 Broadway • New York City

GEARED TO BLEND LIQUID AND DRY MATERIALS



Here's how a major packer of apple products has streamlined the processing of applesauce.



SCHEMATIC DIAGRAM OF OMEGA FEEDING AND BLENDING SYSTEM

Using an Omega Model 50-8 Gravimetric (Weighing) Feeder for feeding sugar and an Omega Rotodip Feeder-Meter for controlling the addition of water and salt solution, this fruit packer has put his complete sweetening and blending process on an automatic basis.

Because of the extremely high accuracy of both Omega Feeders, the automatic proportioning of sugar and liquid into the applesauce far exceeds manual-control methods both in accuracy and dependability. Because this integrated Omega System is continuous in operation, it keeps pace with very heavy processing schedules yet it occupies a minimum of plant floor space.

This and countless other Omega Feeding and Blending Systems are serving industry today — establishing new highs in product quality, uniformity, and productivity. From a purchasing point of view, each Omega System is a "packaged" purchase which includes all essential feeders, drives, and controls required for the application. The pre-tested Omega System arrives on the job as a complete unit, ready to swing into action the minute installation has been completed.

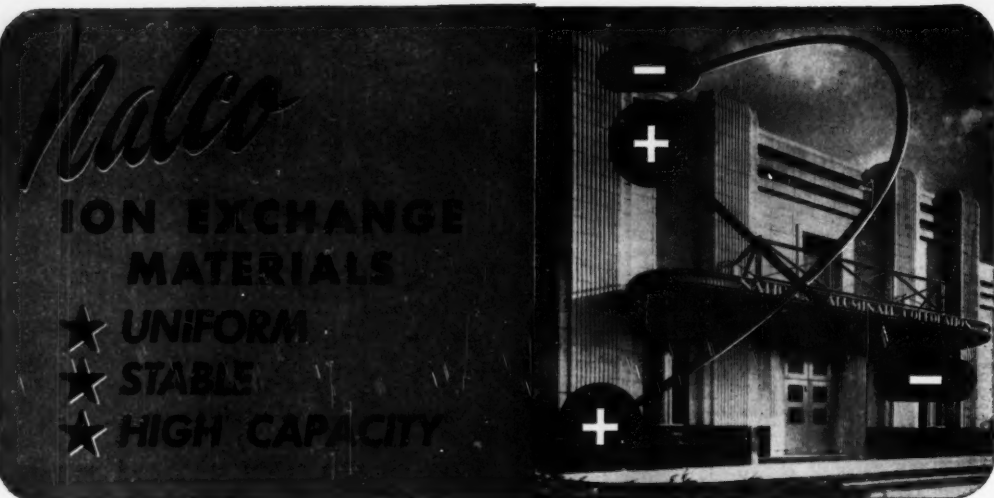
Whatever your processing problem is, Omega is ready to help you. Write today for engineering advice and recommendations. Omega Machine Company (Division of Builders Iron Foundry) 369 Harris Ave., Providence 1, Rhode Island.



OMEGA
THE LAST WORD IN FEEDERS



Omega manufactures a complete line of volumetric and gravimetric feeders for dry materials and for gravity feeding of liquids and solutions.



Outstanding physical and chemical characteristics of Nalco ion exchange materials provide excellent opportunities for development of new processing uses—as well as for maximum utilization of conventional ion exchange techniques. Here are quick facts on three of the Nalco ion exchange materials:

Nalcite HCR

CATION EXCHANGE RESIN

Styrene type cation exchange resin for fast efficient removal of metal ions from water and a wide variety of process liquids. Either salt or acid regeneration. High operating capacity (Up to 32,000 grains per cubic foot) with no capacity loss at high temperatures (Up to 250° F) or over the entire pH range.

Nalcite SAR

STRONGLY BASIC ANION EXCHANGE RESIN

For substantially complete removal of all acid-radical constituents from water and processing liquids. Operates efficiently over a wide pH range (2.0 to 10). Microspheres of uniform size range.

Nalcite WBR

WEAKLY BASIC ANION EXCHANGE RESIN

A new polystyrene-polyamine type anion exchanger of high chemical stability. High capacity for removal of the stronger acids makes Nalcite WBR particularly applicable for demineralization techniques. Supplied in bead form.

NATIONAL ALUMINATE CORPORATION

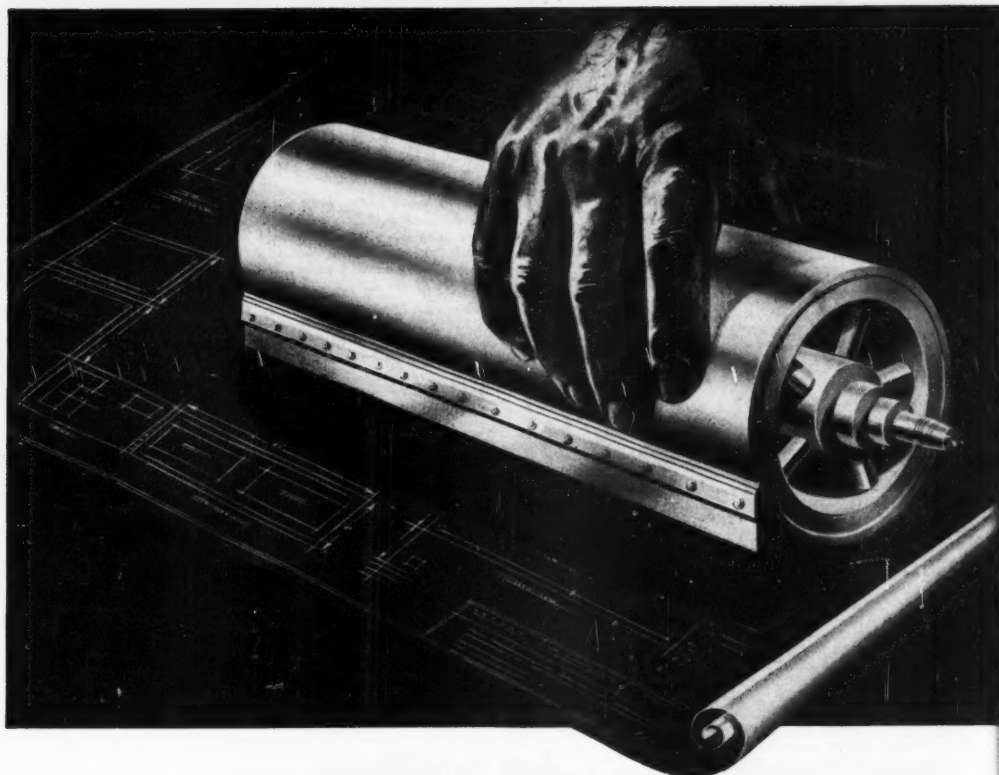
6236 West 66th Place
Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario, Canada

More Data on any or all Nalco ion exchange materials will be furnished promptly upon request. Nalco Laboratory and Engineering facilities available for specialized ion exchange research and development.

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PRODUCTS . . . Serving Industry through Practical Applied Science



How to Plan Higher Output with Faster, Safer Drying

To increase production, a large eastern chemical manufacturer installed a 60" diameter Lukenweld Jacketed Steel Roll to replace one of conventional type, identical in size. When operated at the same pressure as the one it replaced, the new roll increased production 33%—proof that under identical pressures Lukenweld Jacketed Steel Rolls are better heat transfer units. When pressure in the new roll was increased, production jumped 67%.



Whether drying, cooling or flaking, production increases like these

may be within your reach, too, with Lukenweld Jacketed Steel Rolls. Featuring assured safety through use of high-strength rolled steel plate, Lukenweld rolls permit faster drying operation at pressures as high as 350 psi. By restricting steam to a shallow annular passage Lukenweld rolls reach operating temperatures faster . . . reflect pressure variations quicker. In addition, Lukenweld rolls offer the advantages of reduced installation and maintenance costs, more flexible operation.

For information on flaking or drying for the chemical field, write: Lukenweld, Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

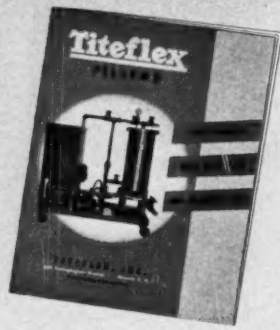
Improved machinery for improved processes through engineering

LUKENWELD

A DIVISION OF LUKENS STEEL COMPANY



REDUCE FILTRATION TROUBLES!



FREE BOOKLET . . . FREE ADVICE

If you need a new or another filter, but are wondering about filter costs, operation, and suitability for your purpose, you have two good friends—your Titeflex Engineer and the Titeflex Filter Booklet.

The Filter Booklet will show you how Titeflex Filters are constructed and how they work.

Your Titeflex Engineer will set you straight on costs and equipment for your special needs. He's the right man to have around if you are having filtration troubles now.

Don't let any thought of obligation to us delay mailing of the coupon below today. We are low-pressure, service-minded engineers, not high-pressure promoters.

Businesses served by Titeflex Filters include . . .

Chemical	Distilling
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Titeflex

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Filters.

☐ We need the advice of a
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without obligation on our part.

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IN WIRE-MESH PRODUCTS

LET JELLIFF DO IT!

For 70 years we've been weaving Wire Mesh. And a good part of that time we have also been making things of Wire Mesh for people who find it is cheaper, easier and generally more satisfactory to "let Jelliff do it."

From big Dipping Baskets to tiny precision filters — from fuel strainers to what-is-it gadgets — JELLIFF'S Custom Production Department turns out fabricated Wire-Mesh products at speed, price and precision that mean lower costs and a stronger competitive position for our many customers.

If you buy or make wire-mesh assemblies as components of your own products and have not yet had an estimate from Jelliff, write today for details. No obligation, even if you enclose a blueprint for us to figure on. Address Department 15.



Schmiege CENTRI-MERGE Still the Best Answer to Your DUST and FUME PROBLEM



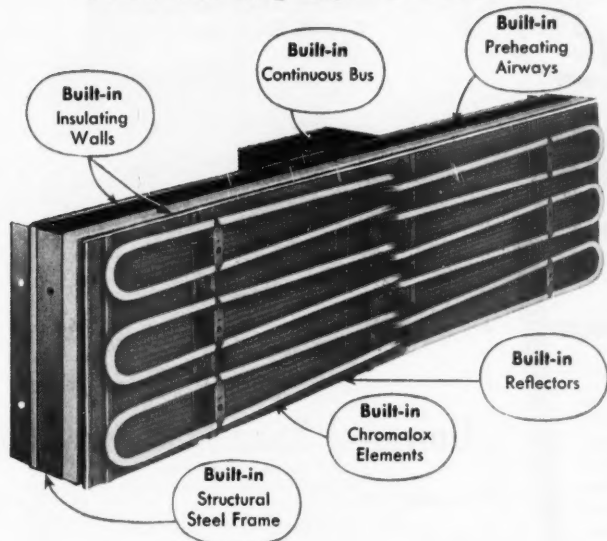
Here are Several Reasons Why—

1. CENTRI-MERGE greatly reduces heating cost by re-circulating cleaned air in many cases, occupies a minimum of valuable floor space, is easily installed.
2. CENTRI-MERGE gives non-fluctuating cleaning efficiency every minute of the day, collects and disposes of dust and fumes immediately.
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4. CENTRI-MERGE eliminates health or fire hazard in dust control by its automatic removal as sludge.
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6. CENTRI-MERGE is engineered for minimum maintenance expense, is a compact, self-contained unit, constructed for flexibility of arrangement to suit plant requirements.

Our engineers will
be pleased to consult
with you in the solu-
tion of your problem.



Announcing a new and better INFRARED Generator



CHROMALOX *Electric* RADIANT PANELS

Now, more efficient far-infrared comes in convenient pre-engineered panels, reducing oven building to a matter of determining heat requirements and assembling panels to fit the job.

CHROMALOX Electric Radiant Panels generate more uniformly absorbed far-infrared heat with quick heat-up and reduced oven lengths.

It's the far-infrared wave length that makes the difference.

- ✓ 9200 Btu's per square foot output per hour.
- ✓ Insulated for voltages to 575 V.
- ✓ Lowest installed cost per kilowatt and per square foot.
- ✓ Built to UL and NBFU requirements.
- ✓ Work temperatures to 700° F. easily obtained.
- ✓ Accurate "dialed" control.
- ✓ Absolutely uniform radiation—no hot or cold spots.

Now... Oven Building as Simple as



It's easy to build ovens of any desired height and length with lightweight Chromalox Electric Radiant Panels. Panels come in 1 x 4 ft. and 2 x 4 ft. sizes, ready to erect and connect with easy-to-follow instructions in each carton. Chromalox on-the-spot engineering assistance to help determine your requirements is yours—no obligation, of course.



CHROMALOX *Electric Heat*

Does More - Better - Consistently

Radiant Heating Division EDWIN L. WIEGAND CO.,
7514 THOMAS BLVD., PITTSBURGH 8, PA.

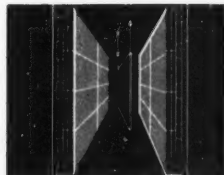
CHROMALOX FAR-INFRARED

*For Baking, Drying,
Curing, Dehydrating*

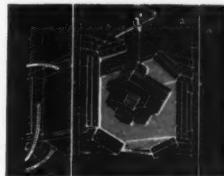
and many other applications.

9 WAYS BETTER

- 1 Longer wave length—absorbed equally fast by all colors.
- 2 Shatter-proof construction—nothing to break and contaminate.
- 3 Non-diminishing output from all-metal Chromalox tubular heat generators.
- 4 Uniform heat—no hot or cold spots.
- 5 High intensity radiation—with more watts per square foot.
- 6 Quick heat-up with energy transformed instantly into heat on the work.
- 7 Low-cost even assembly.
- 8 Infinitely variable output—from 0 to 100% of capacity.
- 9 Additionally safe for any work involving volatiles.



Easily erected banks of Chromalox Radiant Panels are ideal for line production. Far-infrared heat is radiated directly and uniformly without hot spots over entire work area.



Chromalox Radiant Panels can be erected into any oven shape. Rugged construction permits their use in assembly lines, even when hazards of splashed liquids, volatiles and moisture are present.

Get this Bulletin



It contains complete information, specifications and application ideas for the use of Chromalox Radiant Panels. Write for your copy today.

IC-66

YOU CAN
MAKE THE...

"Extra Point" in TUSCALOOSA ALABAMA

If you're looking for that extra advantage in transportation, resources or manpower... the "Extra Point" that spells the difference between profit and loss... better take a second look at Tuscaloosa, Alabama! Industries already in Tuscaloosa are showing profits, say they wouldn't locate anywhere else in the world. There must be a good reason! Let us tell you more about our city.



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NEW INDUSTRIES COMMITTEE INC.
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ALL INQUIRIES WILL BE HELD IN ABSOLUTE CONFIDENCE

GAYCO CENTRIFUGAL SEPARATORS

GAYCO Separators, equipped with the adjustable centrifugal sizing fan—an exclusive GAYCO feature—make closer separations. Closer separations bring about higher production through efficient removal of the fines made by the mill. Closer separations bring about higher quality products by eliminating all undesirable oversize.

"TIMKEN GEARING EQUIPPED"
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If you have an exceptionally hard separating problem
TRY THE GAYCO

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119 LIBERTY STREET NEW YORK 6, N. Y.
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LUBRICATION ECONOMY

LUBRIPLATE LUBRICANT Increased Bearing Life from 2 Weeks to 2 Years!



So says The Globe Company, manufacturer of meat processing machinery. "In the packing industry where animal acids and moisture quickly destroy anti-friction bearings lubricated with conventional lubricants, LUBRIPLATE prolongs the life of bearings from 2 weeks to 2 years."

1. LUBRIPLATE reduces friction and wear
2. LUBRIPLATE prevents rust and corrosion
3. LUBRIPLATE is economical to use

Write today for case histories of savings made through the use of LUBRIPLATE in your industry.

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Fiske Brothers Refining Co.
Newark 5, N.J. Toledo 5, Ohio

*The Different
LUBRICANT!*

DEALERS EVERYWHERE, consult your Classified Telephone Book



THERE'S A
Real live feel—
IN HER DOLL
THIS YEAR

SISSY won't know it, but the wonderful, lifelike touch in her doll this Christmas will mark one more triumph by the vinyl plastic industry in a steady succession of new and improved products for America.

You can include vinyl floor tiles, military tarpaulins, surgical tubing and even portable swimming pools in that list . . . products that gain their all-important property of *flexibility* from their *plasticizers*.

Today, more and more plastics manufacturers are counting on the broad family of quality-controlled Pittsburgh PX Plasticizers for consistent compounding performance and improved characteristics in their finished products.

We can offer these assurances because of our unique position as a basic and integrated producer. That position enables us to control quality and maintain rigid uniformity at every step in the production of Pittsburgh Plasticizers, from coal to finished products.

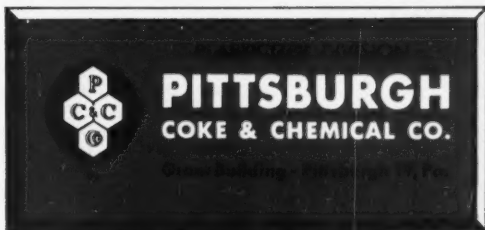
It's the same story in Pittsburgh agricultural chemicals, protective coatings and the products of our other integrated divisions: Higher quality . . . greater uniformity . . . and dependable, continuing deliveries . . . because we're *basic*.



Doll heads and similar vinyl products are often molded from plastisols—dispersions of vinyl resins and plasticizers. Above a Watson-Standard plastisol is being compounded from Pittsburgh PX Plasticizers.

	DiButyl Phthalate	
DiIsoOctyl Phthalate		DiOctyl Phthalate
DiNonyl Phthalate		DiNonyl Adipate
DiIsoOctyl Adipate		DiOctyl Adipate
DiButyl Sebacate		DiIsoOctyl Sebacate
DiOctyl Sebacate		TriCresyl Phosphate
TetraHydroFurfuryl Oleate		

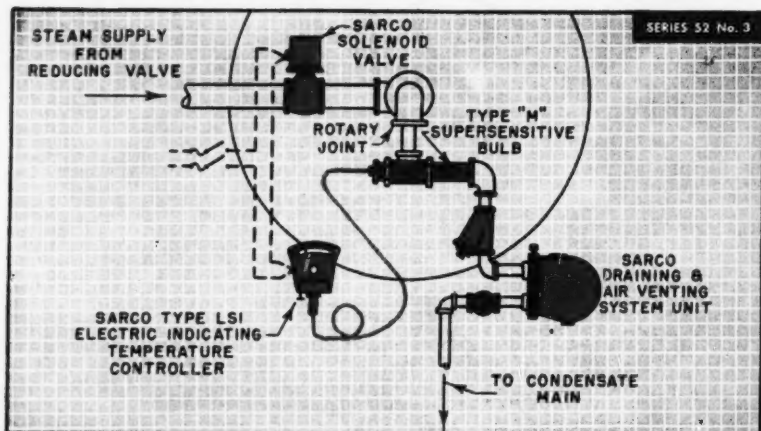
W&O 4392



COAL CHEMICALS • AGRICULTURAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

This sketch shows temperature control applied to a Sarco Draining System for drying cylinders. The Sarco System assures

rapid and continuous removal of condensate. The steam supply is controlled in accordance with load requirements.



more production from DRYING CYLINDERS and ROTARY DRYERS

If YOUR DRYING OPERATIONS include steam heated drying cylinders or rotary dryers, this story is of vital interest to you!

More than one hundred actual installations made in the last two years in the textile, chemical and paper industries have demonstrated that:

- 1 Warming-up time can be cut 10-25%
- 2 Production can be increased 15% or more
- 3 Considerable steam can be saved at the same time by installing the

Sarco Draining and Air Venting System

This System has finally solved the vexing problem of traps locked by steam in the syphon pipes and discharge joints from the cylinder to the steam trap.

Continuous discharge of condensate as fast as formed, plus very rapid purging of air assure more evenly heated drying surfaces—with less steam consumption.

Write for the Technical Bulletins for your industry.

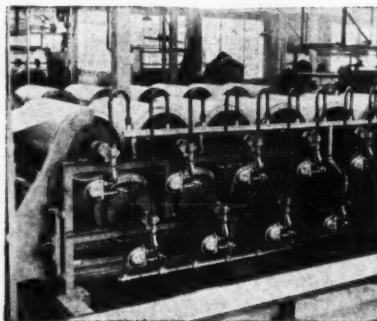
SARCO COMPANY, INC.
Empire State Bldg., New York 1, N. Y.
REPRESENTED IN PRINCIPAL CITIES
Sarco Canada Ltd., Toronto 8, Ont.

SARCO

improves product quality and output



The standard Sarco Draining and Air Venting System consists of a special float-thermostatic steam trap equipped with steam lock release and thermostatic air vent; an air collector pipe with an air vent on top; a strainer and a flow indicator.



Special Sarco Float-Thermostatic Steam Traps equipped with steam lock release and sight glass as used on drying cylinders and rotary dryers in the textile, chemical and paper industries.



HENSZEY

Multiple Effect

EVAPORATORS

... your answer to

- INCREASED EFFICIENCY
- GREATER PLANT CAPACITY

If your processing requires evaporation or condensing operations, you will find a Henszey Multiple Effect Evaporator lowers production costs. They are fabricated of steel or stainless steel (either polished or unpolished finish) especially for the Chemical Industry.

Exclusive Henszey features include the re-use of waste vapor ... automatic feed valves ... full recovery of solids ... elimination of foaming ... PLUS savings up to 70% of the steam and 80% of ordinary water requirements.

Send for descriptive bulletin

HENSZEY COMPANY

DEPT. E-10, WATERTOWN, WIS.



Bottom doors swing open and all inside surfaces are "straight through" — clearly visible and easily accessible for swift, positive cleaning.

HENSZEY

Also Power Plant Specialties including:
 CONTINUOUS BLOWDOWN • FEED
 WATER METERS • HEAT EXCHANGERS
 • INDICATING FLOW METERS
 BOILER FEED REGULATORS
 PROPORTIONING VALVES

WANTED

an engineered product to manufacture and market

We are looking for a new engineered product to manufacture in our plant and market through our sales channels.

It must be capital goods equipment and fill a definite need in one or more of the process industries. We prefer a unit that involves heat exchanging, or combustion, or a combination of both, and can be completely assembled at the factory.

The market potential for it must be sufficiently large to eventually justify production line manufacturing methods.

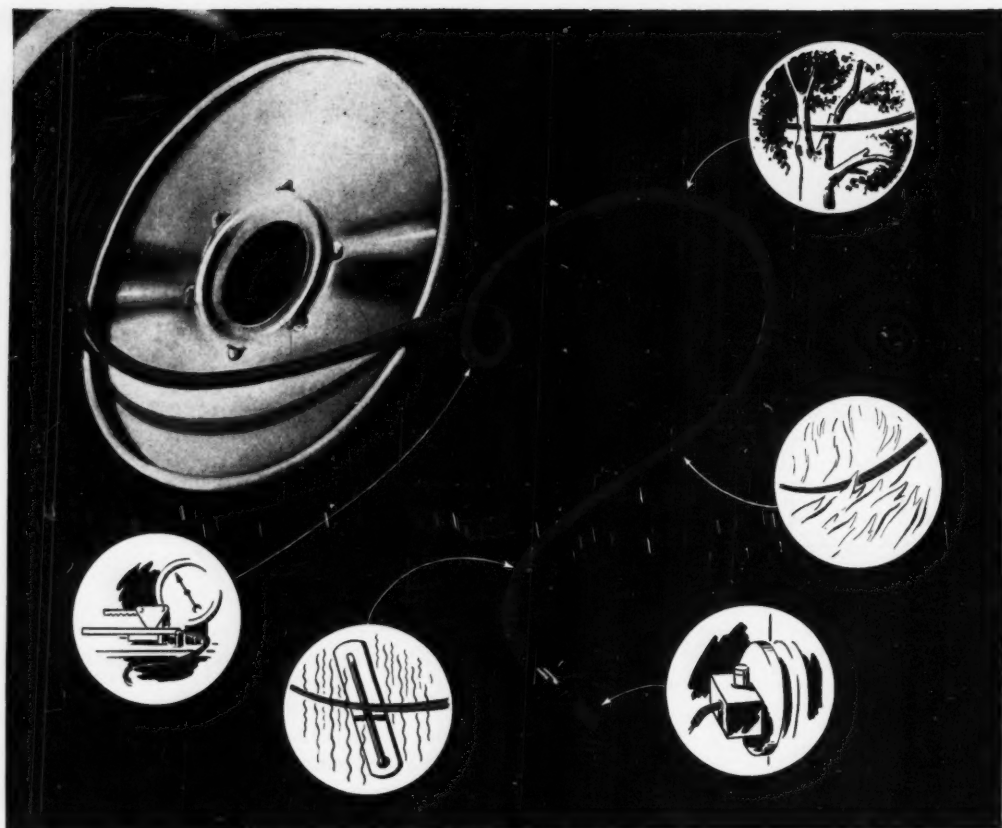
We are an old established manufacturing concern prepared to purchase patent rights or negotiate on a royalty basis. Write us outlining the type of product, its distinctive advantages, and other pertinent facts. If it meets our requirements for further investigation, we will arrange for a personal interview.

Write to

BO-5485

Chemical Engineering

330 W. 42 St. New York 36, N. Y.



Why doesn't somebody make... *rigid vinyl wire insulation like this?*

- Resists elevated temperatures
- Gives exceptional dielectric properties under all conditions
- Virtually eliminates cold flow
- Offers outstanding resistance to abrasion and cut-through
- Has unusual resistance to flame, moisture, and chemical action
- Flexes easily, allowing tight 180 degree bend without fracturing
- Is extruded on conventional equipment

Somebody does! Yes, Naugatuck Chemical, with the unusual protective and insulating qualities of its Marvinol rigid vinyl compounds, is bringing new scope and efficiency to the entire field of electrical design and insulation.

This unique combination of properties that unplasticized Marvinol compounds offer, plus their important

weight and space savings, make them particularly well suited for such electrical applications as telephone frame wires and conduits.

For full technical information on this unusual Marvinol vinyl insulating material, write today to the address below.

Names of fabricators on request.

Naugatuck Chemical

Division of United States Rubber Company

710 ELM STREET, NAUGATUCK, CONNECTICUT

Branches: Akron • Boston • Charlotte • Chicago • Los Angeles • Memphis • New York • Philadelphia • In Canada: Naugatuck Chemicals, Elmira, Ont.

MARVINOL® vinyl resins • KRALASTIC® styrene copolymers • VIBRIN® polyester resins

Rubber Chemicals
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What's your problem?

Many of America's leading chemical industries have found the answers to problems in these processes in products by

FILTROS



The complete line of FILTROS porous, acid proof, silica and chemical porcelain products includes . . .

Flat and Curved plates
Cylinders & Rods
Built-up cells
Grooved bottom plates

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FILTROS is supplied in a wide range of permeability and is air tested to assure absolute uniformity. Much of FILTROS annual sales volume consists of highly specialized porous ceramic products made to individual specifications in cooperation with customers chemists and engineers. A number of chemical, electrolytic, and catalytic processing problems have been solved in this way by FILTROS where nothing else could accomplish satisfactory results.

Many of America's "BLUE CHIP" Industries Are FILTROS Users
FILTROS products are currently in use by these outstanding companies:

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Monsanto Chemical
Penna. Salt Mfg.
Reilly Tar & Chemical
Riverside Portland Cement
Rohm & Haas

FILTROS engineers will gladly cooperate with you on any special problems. Write for detailed information and tell us how we may help.



FILTROS, INC.

567 West Commercial St., East Rochester, N. Y.

Pioneer Manufacturers of
Porous Ceramics—Since 1913



What is 100% Corrosion Safe?

Anything less than 100% safe is 100% UNSAFE.

This fellow's lucky, in a way. He *thought* his safety valves were 100% safe, and because they weren't . . . weren't corrosion proof . . . they might have killed him. Because those valves were *almost* safe, it's going to cost someone a lot of money.

There's only one way to think of safety—think in terms of 100% or nothing. There's one sure way to *get* 100% safety—specify BalanSeal or FarriSeal Valves.

Why? Because they *can't* stick, plug or corrode. Critical working parts are permanently isolated from any contact whatever with the lading.

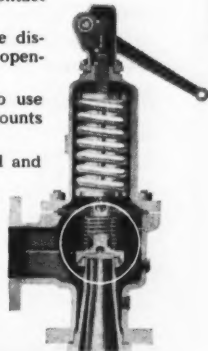
Because they're unaffected by back pressures in the discharge manifold due to its own operation or to the opening of other valves in the line.

Because these features make it possible for you to use smaller discharge piping, an economy which often amounts to substantially more than the cost of the valves.

You'll be interested in the engineering of BalanSeal and FarriSeal Valves—design which is rapidly gaining acceptance in hundreds of successful installations.

Ask for our "8-Minute Brief."

Your Safety's REAL
With FarriSeal



ENGINEERING CORP.

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Call Solway First

Because Solway gives you the dependable quality and uniformity of America's oldest and largest producer of alkalies.

Because Solway can give you delivery service from strategically-located major plants and over 200 local stock points.

Because Solway offers you a Technical Service that is operated on an Industry-Wise basis . . . providing expert advice to individual industries.

Because Solway sales service is handled by a staff of thoroughly trained, helpful salesmen operating from thirteen convenient branch sales offices . . . plus a nation-wide organization of selected jobbers, distributors and dealers.

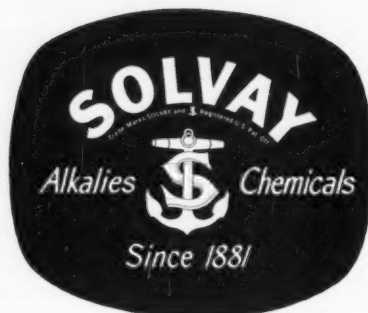
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Chlorine
Potassium Carbonate
Calcium Chloride
Sodium Bicarbonate
Specialty Cleansers

CAUSTIC SODA

Sodium Nitrite
Ammonium Bicarbonate
Para-dichlorobenzene
Ortho-dichlorobenzene
Monochlorobenzene
Ammonium Chloride

(Right) Structural details of Lawrence Vertical Acid Pump.

(Below) Vertical Acid Pump for outside mounting.



VERTICAL ACID AND CHEMICAL PUMPS

The vertical acid pump illustrated here shows how Lawrence engineers met a particularly difficult pumping problem. Chemical action made it imperative to eliminate packing. While packing is used below the top bearing to confine fumes, it does not come in contact with the acid because the liquid level of the supply tank is kept below that point. This construction is typical of Lawrence advanced engineering design.

Other design features of Lawrence pumps for acids and chemicals include the use of metals and alloys carefully chosen to give the best possible protection against the corrosive and abrasive action of the liquid pumped, as well as structural strength and long wear.

If you have to pump any acid or chemical, hot or cold, write us the pertinent details. No obligation.



Send for bulletin 203-4 for a complete summary of acid and chemical pump data.

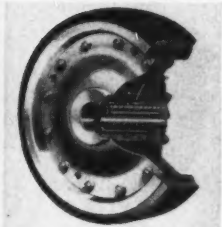


LAWRENCE
MACHINE & PUMP CORPORATION

369 Market Street, Lawrence, Mass.

*For Savings
Specify*

DARNELL
Casters & Wheels



*Whether for light, medium
or heavy duty use, Darnell
Casters and Wheels are
built to take punishment.*

**KEEP TURNING
AND EARNING**

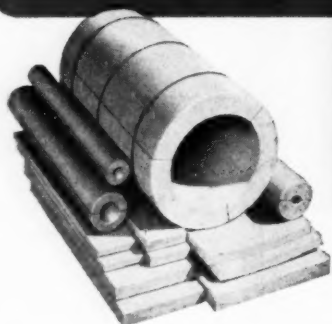
*Built-in quality assures a
long life of efficient ser-
vice—it pays to "Demand
Darnell Dependability".*

**Free
MANUAL**

DARNELL CORP. LTD.
DOWNEY, (Los Angeles County) CALIF.

60 Walker Street, New York 13, N.Y.
36 North Clinton, Chicago 6, Illinois

Pattern for the Future...



MODERN CONSERVATION PROJECT—the new Snyder Gasoline Plant, Snyder, Texas, operated by Sunray Oil Corp. for some 30 companies and 60 individuals. Plant-process heating equipment and steam lines are insulated with Kaylo Heat Insulation. General contractor—The Fluor Corporation, Ltd., Los Angeles, Calif.; insulation contractor—Industrial Insulators, Inc., Houston, Texas.

Leading Refiners Are Switching to KAYLO HEAT INSULATION

The growing trend to Kaylo Heat Insulation is a logical result of the outstanding combination of advantages offered by this revolutionary heat-saving material.

Kaylo Heat Insulation, a hydrous calcium silicate, has high insulating value over a wide temperature range. It is effective up to 1200°F.—thus eliminating the need for combination coverings in nearly all operating conditions.

In addition, Kaylo Heat Insulation has

these excellent physical characteristics: it is insoluble in water and incombustible. It has dimensional stability . . . high strength . . . light weight — properties vital to a superior heat insulation.

Its ease of handling, cutting and fitting simplifies application—saves time on the job. With these important extra advantages, at no extra cost, little wonder that leading refiners are switching to Kaylo Heat Insulation.

KAYLO

... first in calcium silicate

For complete details on Kaylo Heat Insulation, write Dept. N-264, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.



...pioneered by OWENS  ILLINOIS Glass Company

MAIN OFFICE: TOLEDO 1, OHIO—KAYLO SALES OFFICES: ATLANTA • CHICAGO • HOUSTON • NEW YORK • PITTSBURGH • ST. LOUIS

REDUCE DOWN TIME WITH TEFLON

Today miracle Teflon* is a proven product with a record of tough problems solved that is almost too good to believe. But the victories are true; Chemical and Power Products, Inc. has hundreds of actual case histories to back up that fact. Here is one:

One of the largest chemical processors in New Jersey turned to Teflon because, with ordinary packing, every machine in the plant was DOWN ONE DAY IN FOUR. The test set of Teflon packings used by this company was returned to us for inspection after ONE YEAR OF CONTINUOUS RUNNING and was found to be still in good working order. Today Teflon packings and gaskets are used throughout this plant.

Chemical and Power Products, Inc., makes a complete stock of Teflon in sheets, rods and tubes and tape form. Prompt delivery on O-Rings, Teflon or Kel-F, in all sizes is assured. Send for our illustrated booklet today to get the complete story of Teflon and Chemical and Power Products' services. Address Dept. CE10.

*Teflon is du Pont's trademark for its tetrafluoroethylene resin.



KOPPERS beta-Resorcylic Acid (BRA)

● beta-Resorcylic Acid is 2,4-dihydroxybenzoic acid and is a derivative of resorcinol.

It is useful for the production of specialty dyestuffs, pharmaceuticals, photographic chemicals, cosmetic preparations, and fine chemicals.

REACTIONS: beta-Resorcylic Acid reacts to form many derivatives by halogenation, condensation, acylation, coupling, nitration, sulfonation, ether formation, esterification, and mercuration. Decarboxylation of certain substituted BRA derivatives yields the corresponding resorcinol derivative.

SPECIFICATIONS

Physical State:	Crystalline Powder
Color:	White to Cream
Purity, % BRA, minimum:	98.0
Melting Point, °C, minimum:	215
Moisture, % maximum:	1.0
Asb, % maximum:	0.5

The properties, reactions, and uses of BRA are discussed in Koppers Technical Bulletin C-9-131. For further information write to:



KOPPERS COMPANY, INC.
Chemical Division, Dept. CE-10
Koppers Building, Pittsburgh 19, Pa.



R/M Teflon Products Catalog gives complete data on many different types of packings and gaskets, as well as sheets, rods and tubes.



R/M No. 800—A resilient, non-adhesive Teflon "envelope" gasket for flanges and similar applications up to 12" I.D.



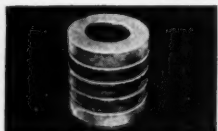
R/M No. 805—A Teflon gasket of folded envelope construction in sizes over 12" I.D. For distillation columns, manholes, etc.



R/M No. 810—Solid Teflon rings for standard ring type flanges. Designed to fit inside bolt circle. Irregular shapes also available to your specifications.

NOW! **A COMPLETE LINE** **OF PACKINGS** **MADE OF**

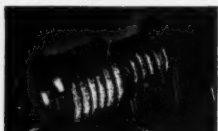
R/M Teflon*



R/M No. 830—These Teflon stuffing box rings are compounded of Teflon and suitable materials fabricated to exact dimensions. Furnished with Teflon spacer rings.



R/M No. 835—Teflon Valve Stem Packing. Wedge type rings for slow-moving rotary and reciprocating shafts. Angular and solid rings also available.



R/M No. 840—Teflon Braided Packing. High grade asbestos yarns impregnated with Teflon Suspensoid for a wide variety of packing requirements.



R/M No. 850—Teflon Vee-Flex® Packing. This unique R/M ring design assures automatic, long-lasting sealing. Design has been used in thousands of applications and proved by photoelastic and radial pressure tests.

Raybestos-Manhattan manufactures a complete line of R/M Teflon Packings and Gaskets for the chemical industry.

Teflon shows no reaction against chemicals except for fluorine gas and chlorine trifluoride, both at high temperatures, and molten alkali metals. No known industrial acids or caustics will attack Teflon; it has no known solvent. Water absorption is zero, and weather does not affect it.

R/M Teflon Packings and Gaskets are available in a variety of combinations for glass, glass-lined and stainless steel piping, and for pumps, valves and practically all fluid-handling equipment.

If you fabricate your own parts, order R/M Teflon in sheets, rods or tubes to specifications.

Write today for catalog of R/M Teflon Products.

*Du Pont trade-mark for its tetrafluoroethylene resin

R/M

PACKINGS

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PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manhattan, Pa.; No. Charleston, S.C.; Passaic, N.J.;
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Industrial Rubber Products • Asbestos and Diamond Products • Refractory • Control Equipment • Brake Linings •
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ANTHRAFILT*

Is the
**HARD COAL
FILTER
MEDIUM**

that

SAVES
IN
many, many ways

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ANTHRAFILT*

provides:

- GREATER CAPACITY
- LONGER FILTER RUNS
- CLEANER WASHINGS AT LOWER COST
- REMOVES ENTRAINED TURBIDITY FROM INDUSTRIAL PROCESS SOLUTIONS OR WASTES

We invite you to write us today for full details and recommendations. A prompt reply is assured.

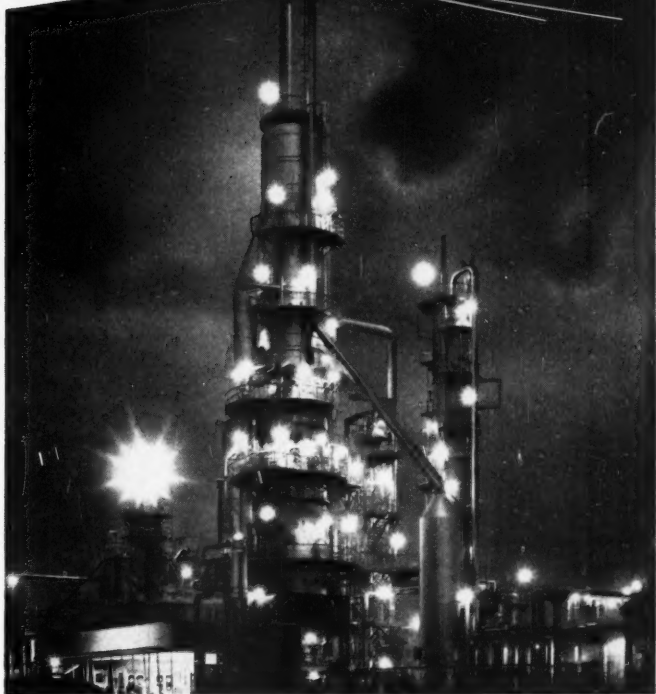
PALMER FILTER EQUIPMENT COMPANY
822 East 8th St., P. O. Box 1655, Erie, Pa.

*Trade Mark Reg. U. S. Pat. Off.

**ANTHRACITE
EQUIPMENT CORPORATION**
Anthracite Institute Building
WILKES-BARRE, PA.

DAY

AND NIGHT



"Photo courtesy of Oil and Gas Journal"

NATIONAL AIROIL

OIL-GAS

TANDEM COMBUSTION UNITS

PATENTED NOV. 1943, DEC. 1948—JUNE 1950.

Night and day the clock around, week after week, month after month, NATIONAL AIROIL Tandem Combustion Units ceaselessly assure "continuous operation" for petroleum heaters in refineries throughout the Nation and the world.

NATIONAL AIROIL Tandem Units are more than just combustion equipment. They are an exclusive Combustion System which, when fired with NATIONAL AIROIL Combination Oil and Gas Burners, virtually eliminates shutdown for any cause of its own. Think what this means in vitally important, additional hours "on stream"!

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CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

Main Office & Factory: EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

- ① Low-temperature drying with agitation
- ② For a wide range of products
- ③ Rapidly and economically in
- ④ **BUFLOVAK Vacuum Rotary Dryers**

A Headline that is also a Helpline!

BUFLOVAK BUILDS

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Low Temperature
By-Product Recovery
Chemicals
Food Products
Crystallization

Dryers

Vacuum Double Drum
Vacuum Rotary
Pilot Plant
Atmospheric

Processing Kettles

Mixers
Impregnators
Dopp Kettles
Solvent Recovery &
Distillation Equipment

① **BUFLOVAK Vacuum Rotary Dryers** give profit-building results. They are used for drying materials requiring low temperature and agitation, and for the recovery of volatile solvents from materials or dregs after leaching or extraction processes.

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Send for Catalog No. 341.

Stainless Clad Agitator with center heating tube and arms being inserted in a 6' dia. x 36" long Vacuum Rotary Dryer.

P.S.

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RESEARCH
and TESTING
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DIVISION OF BLAW-KNOX CO.

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MECHANIZE MATERIALS HANDLING

**WITHOUT COSTLY INSTALLATIONS
OR LOSS OF PRODUCTIVE TIME**

**use an Allis-Chalmers HD-5G
and Tracto-Shovel
Attachments**



You speed materials handling "right now" when you put this fast-working tractor-shovel combination on the job. The HD-5G starts boosting production without waiting for costly installations or changes in plant layout. Digs into the toughest jobs, indoors or out . . . lifts, loads, excavates, pushes, tows . . . handles all materials, bulk, solid or packaged.

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Choice of thirteen interchangeable Tracto-Shovel attachments makes the HD-5G a one-tractor material handling fleet. Special buckets, lift fork, crane hook, rock fork, 'dozer blades and others may be interchanged in a few minutes with simple tools.

LIFT FORK ATTACHMENT

Stacking Height
(under forks) — 106 in.
Lifting Capacity
— — — — 4,000 lb.



CRANE HOOK

Lifting Height
(hook to ground) — 138 in.
Lifting Capacity
— — — — 5,000 lb.



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HD-5G THE MODERN TRACTOR IN EVERY WAY

Designed For Your Job • Built To Take It • Easy To Service
Easy To Operate

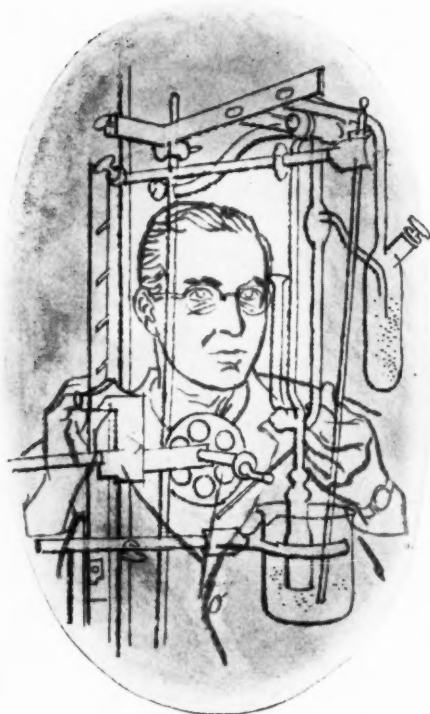
40.26 drawbar hp. • 1 cu. yd. bucket
Dumping height — 9 ft., 1/4 in.

ALLIS-CHALMERS TRACTOR DIVISION
1127 South 70th St., Milwaukee 1, Wis.

Please send me literature on the Tracto-Shovel
line ranging from 1 to 4 cu. yd.

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Title.....
Company.....
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ethyl bromide C_2H_5Br



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Ethyl bromide is an important intermediate used as an ethylating agent in the synthesis of many organic chemicals including drugs and dyes. Place your order with Dow. You'll like doing business with us.

Other typical Dow bromides:

Isopropyl bromide	2,4,6 - Tribromophenol
Bromoform	Amyl bromides
Allyl bromide	Butyl bromides
Trimethylene chlorobromide	Trimethylene bromide

properties

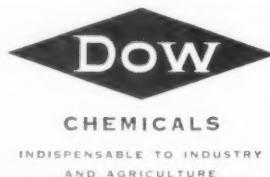
Ethyl bromide is a clear, colorless, volatile liquid with a pleasant odor and sweet taste.

Boiling point at 760 mm. Hg	38.4°C.
Freezing point	-119.0°C.
Specific gravity at 25/25°C.	1.451
Pounds per gallon at 25°C.	12.07
Refractive index at 25°C.	1.421
Flash point	none
Fire point	none

The Dow Chemical Company
Department FC 45, Midland, Michigan

Please send me an experimental sample
of ETHYL BROMIDE.

Name _____ Title _____
Company _____
Address _____
City _____ State _____



Thermo-COUPLES

**with Quick Coupling
Moistureproof
Connectors**

When thermocouple connections are broken frequently and are exposed to moisture or are located outdoors, you can quickly connect thermocouples to extension wires and seal the connections against moisture by installing thermocouples with quick coupling connectors — covered with neoprene, slip-on jackets. Illustrated is a Protected Thermocouple with plug and jack connector and moisture-proof jacket. Available in all standard thermo-elements.

These and many other types of thermocouples and connectors are described in our catalog E

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FAIR LAWN NEW JERSEY



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SINCE 1911**

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BECAUSE:

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ALLOY

315 sq. ft. Hastelloy B tube bundle for HCL stripper reflux condenser. Tubes welded to tube sheet. Bundle heat treated at 2100—2150°F. for 30 minutes.

NON-FERROUS

Aluminum condenser (steel channels and backing flanges) with compensating shell expansion member. Aluminum welds by inert gas-shielded arc method.

NON-METALLIC

Tube-within-a-tube cooler. 2" Pyrex glass #774 inner pipe and 3" standard steel outer pipe. Design pressures 100 psig both sides.

EQUIPMENT

EXCHANGERS

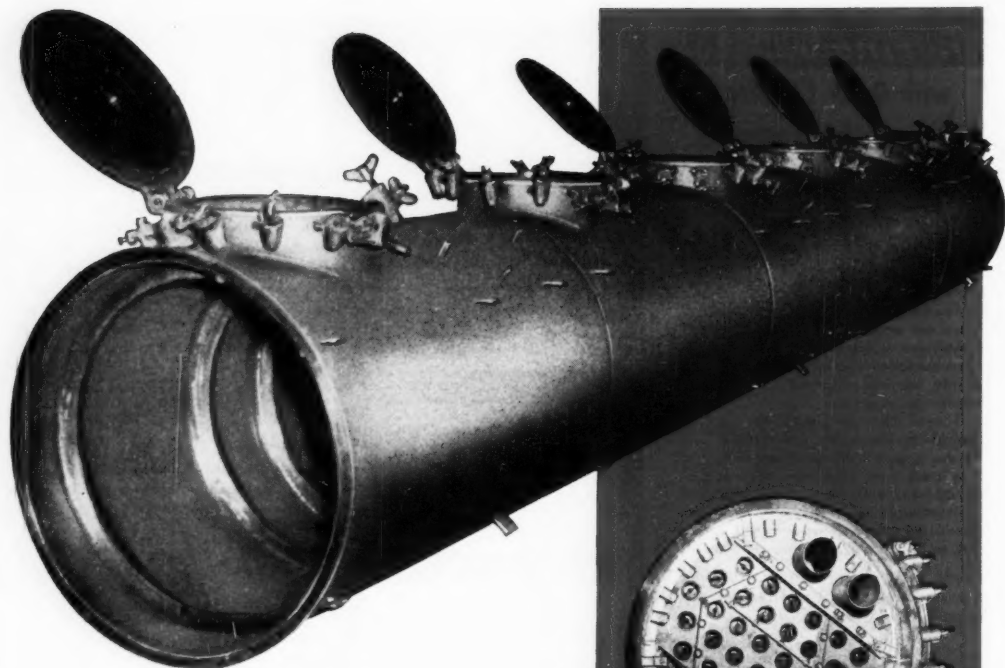
Typical process exchanger (Type ST straight tube, floating head design — split ring assembly) for vapor condensing service.

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5' x 12' propane storage drum with 18" manway and davitt cover. Design pressure 400 psig — U-68 construction including stress relieve and x-ray.

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Individual section of copper distillation column. Column I.D. 49 1/4". Seven sections per column.



Type 316 stainless steel bubble tray column recently built by Pfaudler for Armour & Co.

Assure desired performance at lower cost with Pfaudler Alloy Towers

Whatever your requirements for fractionating or stripping columns, for bleaching or absorption towers; Pfaudler is prepared to meet them at the *lowest possible cost* to you.

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*FRUSTROSY is that frustrated condition a man gets into when his problem is Viscosity Determination or Control and he hasn't asked BROOKFIELD.

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Self-contained and self operating, requiring no outside power supply . . . for hot water storage heaters and tanks, canning retorts, exhaust boxes, scouring bowls, etc.

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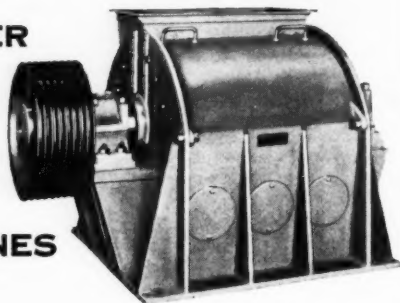
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THAT

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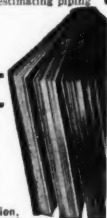


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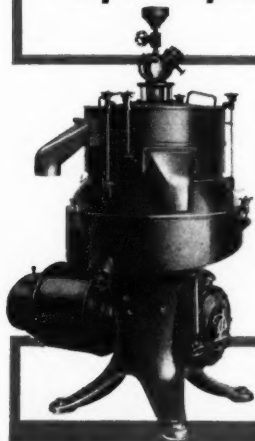
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*is all-important
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- to speed
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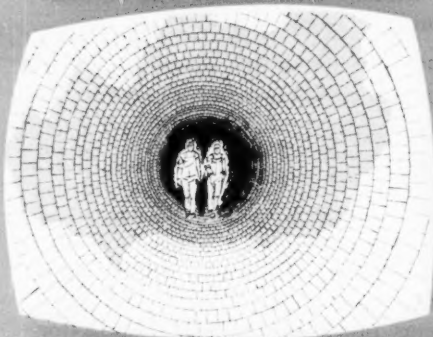
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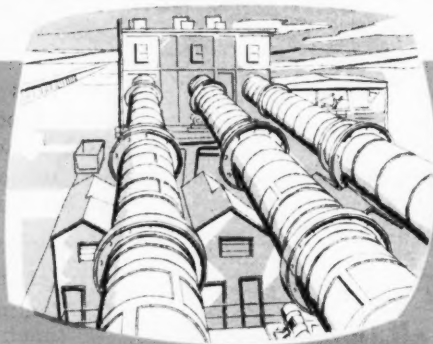
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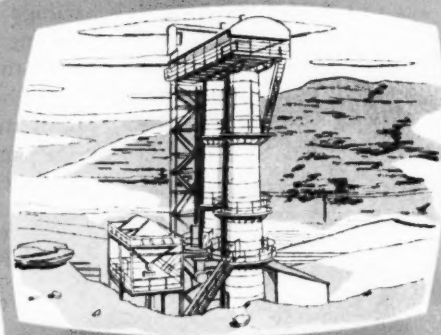
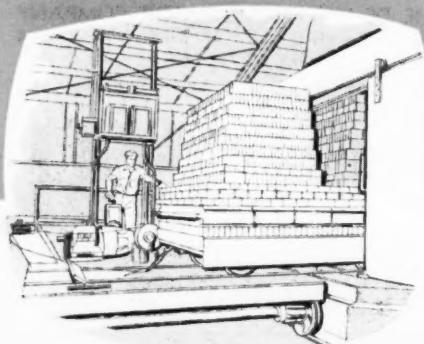
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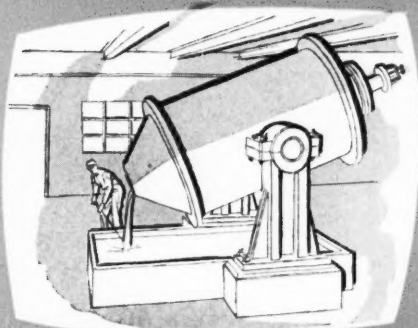


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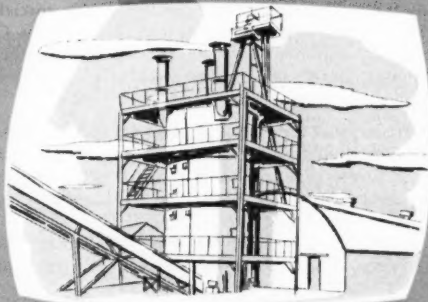
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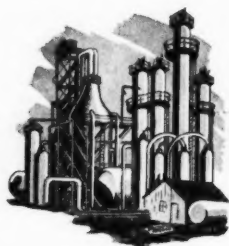
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CHEMICAL ENGINEERING—October 1952

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*in the
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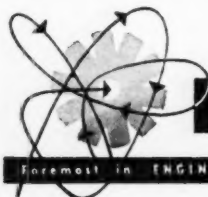


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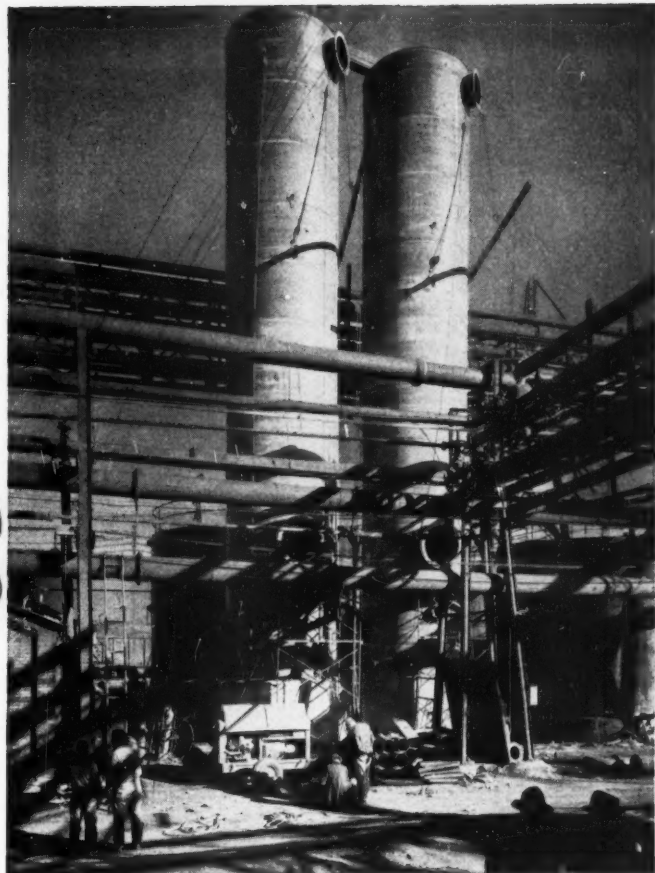
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International Division: P.O. Box 2023, Milwaukee 1, Wis., U.S.A.

WHAT LIES **BEHIND** THE SCENES . . .



IN HEAT TRANSFER

THE BIG 3—MEN . . . MACHINES . . . MATERIALS.

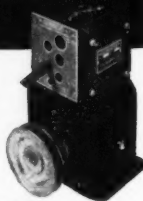
Materials—the where-with-all to do the job . . . Machines—a way to get it done quickly and economically . . . but it's the MEN OF WESTERN that give the matchless heat transfer engineering SERVICE which assures top-quality "on stream" performance as well as dependable delivery to meet YOUR construction time-table. For heat transfer equipment TAILORED to the individual needs of your particular processes, consult with WESTERN . . . big enough to do the job . . . small enough to give personal attention in sizing, rating, design and fabrication of all shell and tube exchangers . . . floating head exchangers . . . atmospheric sections . . . reboilers . . . aerial coolers . . . and telescopic exchangers.

All Western Heat Exchange Equipment fabricated to strict TEMA or ASME standards.



Here's a way to **PUMP**

Liquids, Gases,
Solids in
Solution



with
NO CORROSION
NO CONTAMINATION

The Pressure of automatic "fingers" on flexible tubing pumps liquids, gases and solids in solution reliably and inexpensively without contamination or corrosion.

SIGMAMOTORS are quickly adaptable to handle different fluids and solids in solution and they may be used for small flows or proportional flows of two or more liquids. Flow rates range from 1 1/2 to 30 gallons per hour with no speed changes.

WRITE for details on the convenience, safety and economy of SIGMAMOTOR pumping.

SIGMAMOTOR Inc.
17 NORTH MAIN ST., MIDDLEPORT, N. Y.

SYNTRON

"Vibrating"

TEST SIEVE

SHAKERS



**Eliminate
all
Guesswork**

**Provide definite sizing of
test samples**

- Use standard 8" Screen Scale Testing Sieves
- A reset timer for accurately timed test periods
- Controlled electromagnetic vibration—no motors, pulleys, etc.

Write Today for **FREE Catalog Folder**

SYNTRON CO.

610 Lexington Ave. Homer City, Pa.

McQuay

DOWN FLOW
UNIT HEATERS

*...the answer
on how to beat
wasted ceiling
heat!*



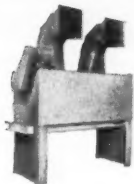
Save the hot air ordinarily wasted in buildings with high ceilings with McQuay Down Flow Unit Heaters. These vertical unit heaters have the famous Ripple-Fin Coils—providing peak heating efficiency and will lower your heating costs by circulating evenly and gently this normally wasted stratified air.

There are 22 Down Flow Units available to meet your exact requirements. Capacity range from 25,400 to 500,000 Btu per hour. Four styles of directional air diffusers are available to provide any desired air distribution.

Consult the McQuay representative in your city, or write McQuay, Inc., 1622 Broadway St. N.E., Minneapolis 13, Minnesota.



HORIZONTAL UNIT HEATERS



These unit heaters are offered for normal applications where horizontal air flow is desired. In 24 sizes with capacities ranging from 20,300 to 360,000 Btu per hour.

BLOWER TYPE UNIT HEATERS

For effective heat distribution over large open areas. Available in 8 sizes . . . in suspended and floor models, with one and two row coils; capacities from 20,600 to 1,600,000 Btu per hour.

ONLY *McQuay* OFFERS ALL THESE
PROVED AND PREFERRED FEATURES:

- Ripple-Fin Construction
- Distinctive Styling
- Non-Ferrous Coil
- Steam or Water
- Certified Ratings
- Maximum Air Throw
- Quiet Operation
- Efficient Performance
- Long Life

REFRIGERATION
AIR CONDITIONING
HEATING



McQuay
INC.

HERE'S REAL INSURANCE AGAINST WORKMAN CARELESSNESS



Lapp TUFCLAD



SOLID

CHEMICAL PORCELAIN

ARMORED

WITH FIBERGLASS—

REINFORCED PLASTIC

No chance for accidental damage to Lapp Chemical Porcelain with TUFCLAD Fiberglass-reinforced plastic! Strong Fiberglass fabric is impregnated and bonded in multiple layers to the porcelain with an Epoxide resin of high strength and chemical resistance. It cushions blows in handling and operation—acts as an insulator against thermal shock. Besides, the TUFCLAD armor is of itself strong and tough—it will hold operating pressures against gross leakage even when porcelain is damaged by accident, explosion or fire. Enjoy the purity and corrosion-resistance of solid porcelain in a system with this new added protection to personnel, equipment and product. WRITE for description and specifications.

Lapp Insulator Co., Inc., Process Equipment Division, 527 Maple St., Le Roy, N. Y.

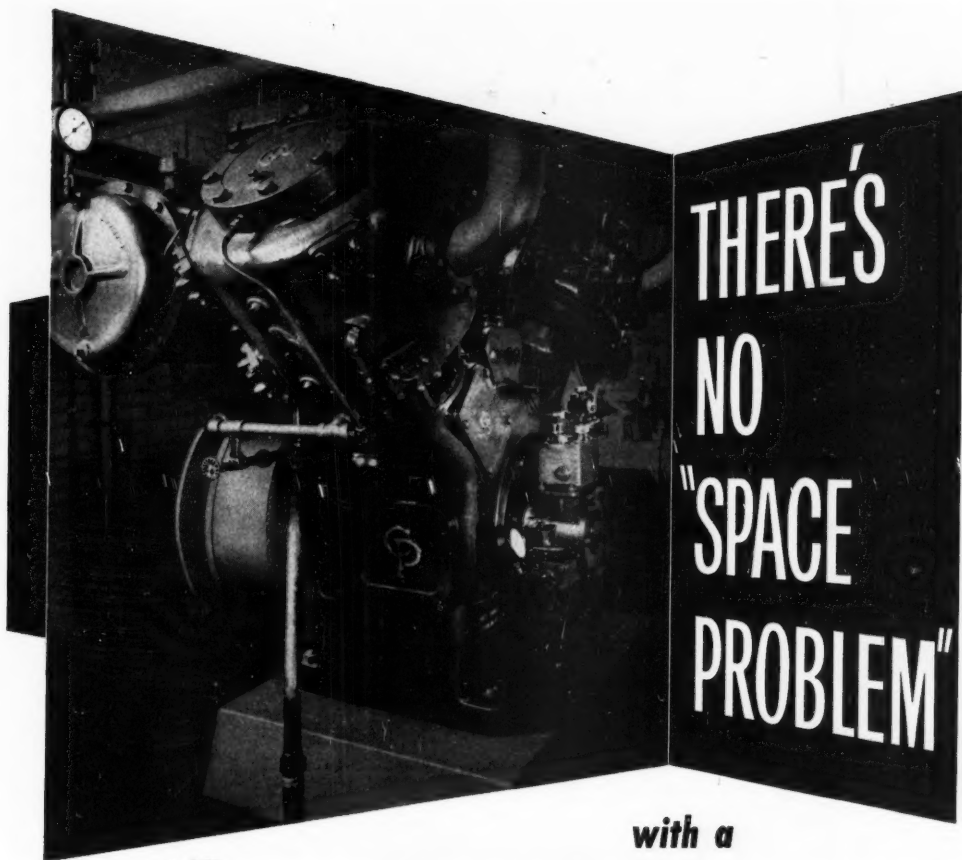
Y-Valves and Angle Valves (in sizes to 6"), safety valves, flush valves, plug cocks, are available in Lapp solid porcelain with TUFCLAD armor. Also pipe and fittings (to 8") and a variety of special shapes.

Lapp

PROCESS EQUIPMENT

CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS
PULSAFEEDER CHEMICAL PROPORTIONING PUMPS





with a
Class Y Compressor

— and only a simple foundation is needed for this exceedingly compact unit.

Shipped intact as a "package" requiring only external connections, the Class Y is easy and inexpensive to install, and may readily be moved, intact, to another location if desired.

Yet it is built for continuous, heavy-duty service, with CP features that assure high efficiency and low maintenance . . . large area Simplate valves . . . multi-step capacity regulation . . . effective inter-cooling . . . precision bearings . . . force-feed lubrication.

In sizes from 75 hp. to 250 hp., 500 cfm to 1663 cfm; with direct-connected, flange-mounted synchronous or squirrel cage motor. Also available with belted and coupled motors.

Write for Bulletin 766



PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
 ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



PROFITABLE MANPOWER

This man may have been good with a wheelbarrow and hand shovel, but his productive capacity is several times greater as a "PAYLOADER" pilot. He's happier and so is his boss, because they both make more money.

"PAYLOADER" tractor-shovels are helping fertilizer and chemical plants slash production costs. They actually pay for themselves in a few months doing the many jobs listed here . . . doing them faster and cheaper — and release manpower for more productive work.

These special tractor-shovels are available in seven sizes, from 12 cu. ft. to 1½ cu. yd. to master your jobs both indoors and outdoors. Get full facts *now* on cost-cutting, time-saving, production-boosting "PAYLOADER". The Frank G. Hough Co., 754 Sunnyside Ave., Libertyville, Illinois.

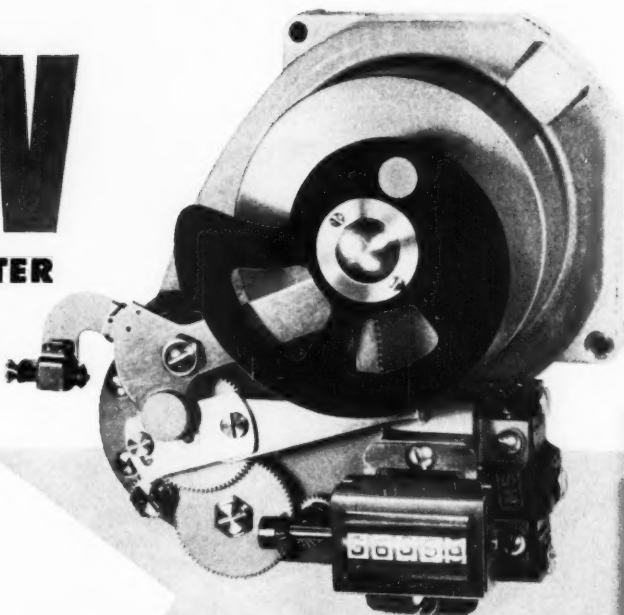
FOR MANY JOBS. Unload box cars — dig and carry fertilizers, chemicals and all loose materials — feed conveyors, hoppers, baggers, elevators — unload trucks — load box cars — carry bagged materials — clean up aisles, gangways — maintain private roadways — stockpile and carry coal — handle ashes — remove snow — spot cars — lift, haul, push, pull.



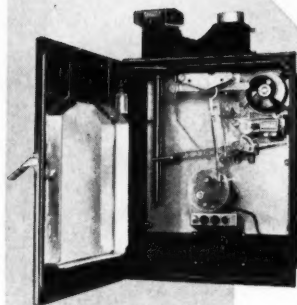
and "Industrial Handling" is full of profitable ideas developed by "PAYLOADER" users. A request on your letterhead gets you on the regular mailing list without cost.

new

FISCHER & PORTER FLOW RATE INTEGRATOR



New . . . and providing a degree of precision never before approached — plus Fischer & Porter adherence to quality of design and components . . . the new 1600 Series Integrator merits your careful analysis.



Complete information
on the new Series 1600
Integrator is yours for
the asking.



Measure these outstanding benefits:

- 1 High speed—only $2\frac{1}{2}$ seconds between counts. Follows rapid fluctuations in input signal with highest fidelity.
- 2 Motor drive — GE type SMY, low speed synchronous motor — absolutely unique in this field.
- 3 Standard or explosion proof available from stock.
- 4 Completely enclosed mechanism—new die-cast aluminum case built to meet unusual dust tight, vapor tight, waterproof or explosion proof requirements.
- 5 All mechanisms completely enclosed, permanently lubricated.
- 6 Mechanical accumulator — unique F & P design of an infinitely variable roller clutch and reverse brake mechanism, magnetically loaded eliminating springs and friction. Entire mechanism oil immersed for permanent cleanliness, lubrication, and freedom from wear and corrosion.
- 7 Motor drive gears and overtravel crank enclosed and permanently lubricated with silicone instrument grease.
- 8 New counter — clearly visible — no peep holes.
— available with predetermining counters for limiting process quantities.
— available with reset, remote electric repeater counters.
- 9 Input cams available for linear, square root or fractional power flow or other functions.

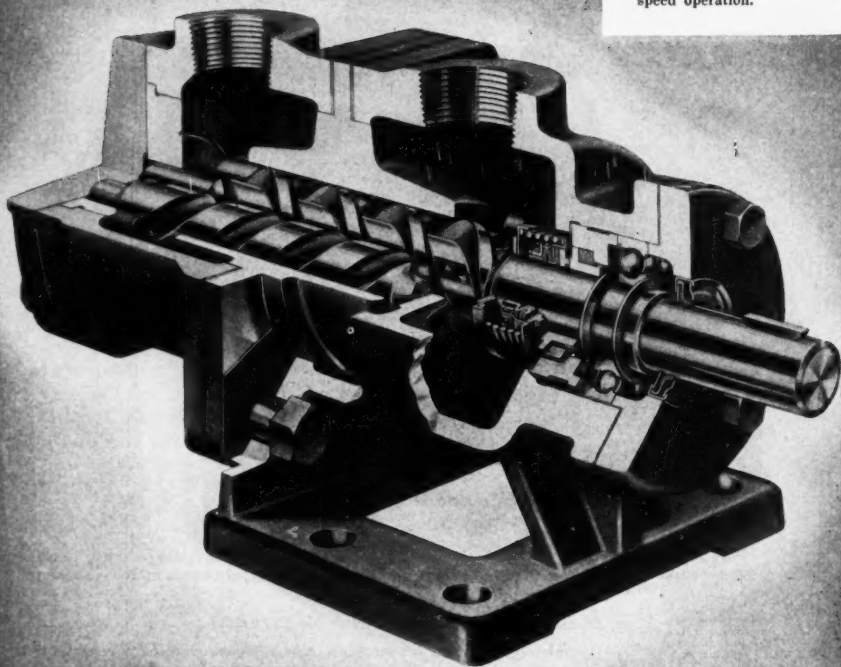
FISCHER & PORTER COMPANY

Ⓔ1854-R

600 COUNTY LINE ROAD, HATBORO, PENNA.

Newest IMO pump – Greatest savings

Note simplicity of unique IMO design — only three moving parts. IMO is reliable, quiet, pulsation-free, compact, excellent for direct-connected, high-speed operation.



DE LAVAL
offers immediate
delivery of new
IMO PUMP
Write today

DL 147

This newest De Laval IMO pump — Model A313B — can be used profitably on a wide variety of hydraulic applications for higher pressures. Quantity-produced to help trim your costs, the new IMO saves you up to 40% in initial cost over other IMO models for pressures up to 275 psi. In addition, this quality-designed rotary positive displacement pump gives you all the low-maintenance advantages of the famous IMO pumping principle.

Put the new De Laval IMO A313B pump to work handling light or viscous fluids in hydraulic systems, rotary and steam atomizing oil burners, lubrication, governing systems and similar services. Specify it for capacities to 80 gpm, pressures to 275 psi and intermittent pressures to 325 psi.



DE LAVAL *IMO Pumps*



DE LAVAL STEAM TURBINE COMPANY
Nottingham Way, Trenton 2, New Jersey

HUDSON ENLARGES GUARANTEE ON MULTIWALL SACKS: NOW COVERS DAMAGE ON PACKER

Will replace without cost any Hudson Multiwall Sack broken on packing or closing machines

NEW YORK CITY. The Hudson Pulp & Paper Corp. has announced the terms of an unusual new guarantee to purchasers of Multiwall Sacks. In the first such guarantee in Multiwall Sack history, the company binds itself to replace any Hudson Multiwall Sack which bursts, tears, splits, or otherwise fails in the course of packing or closing. Hudson emphasizes that this new guarantee is in addition to their usual warranties of quality and workmanship implicit in every contract.



A typical scene showing Multiwall Sacks being filled and closed. Now, for the first time, a Multiwall Sack manufacturer is guaranteeing to replace any sacks broken during such operations.

Multiwall Sack Users urged to investigate this offer

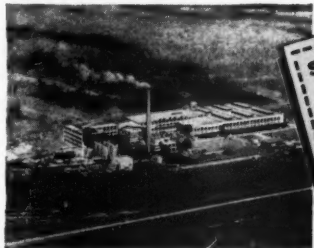
The new Hudson guarantee plan went into effect with all sacks purchased on or after Sept. 15, 1952. Multiwall Sack buyers who have learned of this new plan have hailed it as one of the most important developments in years.

Full information regarding the scope and benefits of the guarantee is being sent, without obligation, to all Multiwall Sack buyers who request it.

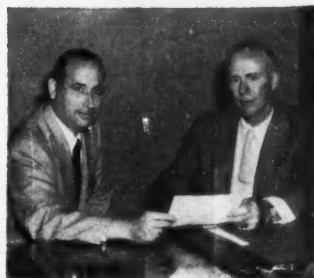
Integrated Hudson mill assures delivery

Hudson Multiwall Sack contracts are backed up by a fully integrated new

mill at Palatka, Florida. Because every step of manufacture is under one control, Hudson is certain all sacks are made to your exact specifications, and are shipped when they are promised!



Though Hudson's Palatka mill is new, Hudson has 42 years of paper making experience.



T. H. Mittendorf (right), Hudson Vice President in Charge of Sales, and J. B. Mendelsohn, Multiwall Sack Sales Manager, look over the first printed copy of the company's unusual guarantee on Multiwall Sacks.

World's most fully guaranteed Multiwall Sack

Hudson has such faith in the quality of its Multiwall Sacks that it gives the world's fullest guarantee on their performance. While other companies warrant their sacks only against abnormal breakage, Hudson guarantees that *all* its sacks must successfully pass *all* filling and closing operations, or be replaced without further cost.

Urge Multiwall Sack users to write for facts

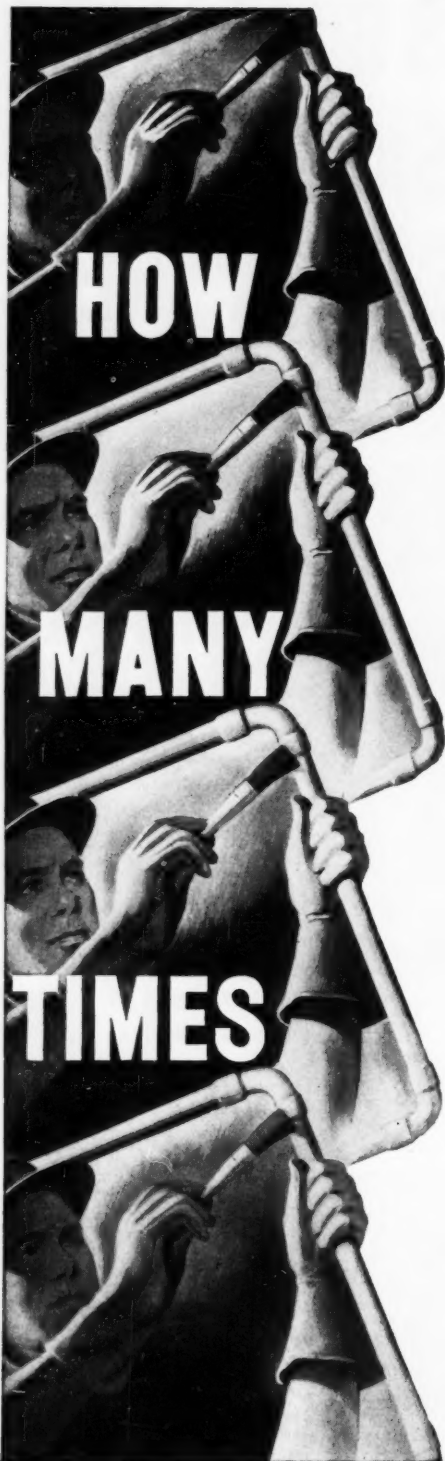
The Hudson Pulp & Paper Corp. invites all users of Multiwall Sacks to learn how they can save money by using guaranteed Multiwall Sacks.

Send for full details:
Tell me all about your money-saving guarantee, at no obligation.

NAME _____
COMPANY _____
STREET _____
CITY _____

HOME _____ STATE _____
by _____
be worth _____

Hudson Pulp & Paper Corp.
Dept. 131, 505 Park Ave., New York 22, N.Y.



HOW

MANY

TIMES



... MUST YOUR PLANT REPLACE INDUSTRIAL PROCESS LINES?

Why take a chance on costly replacements and repairs when Chase® Copper Water Tube is ideal for most industrial process lines?

Chase Copper Water Tube is rustproof and corrosion-resistant. Installations made in process industries years ago, are free of rust and smooth as ever inside. Fluids flow through copper tube easily and pumping costs are kept down.

Chase Copper Water Tube, and Chase Solder-Joint fittings make pressure-tight, leak-proof connections. Chase Copper Water Tube is light in weight, easy to install. It comes in long lengths that require fewer joints, saves time and money.

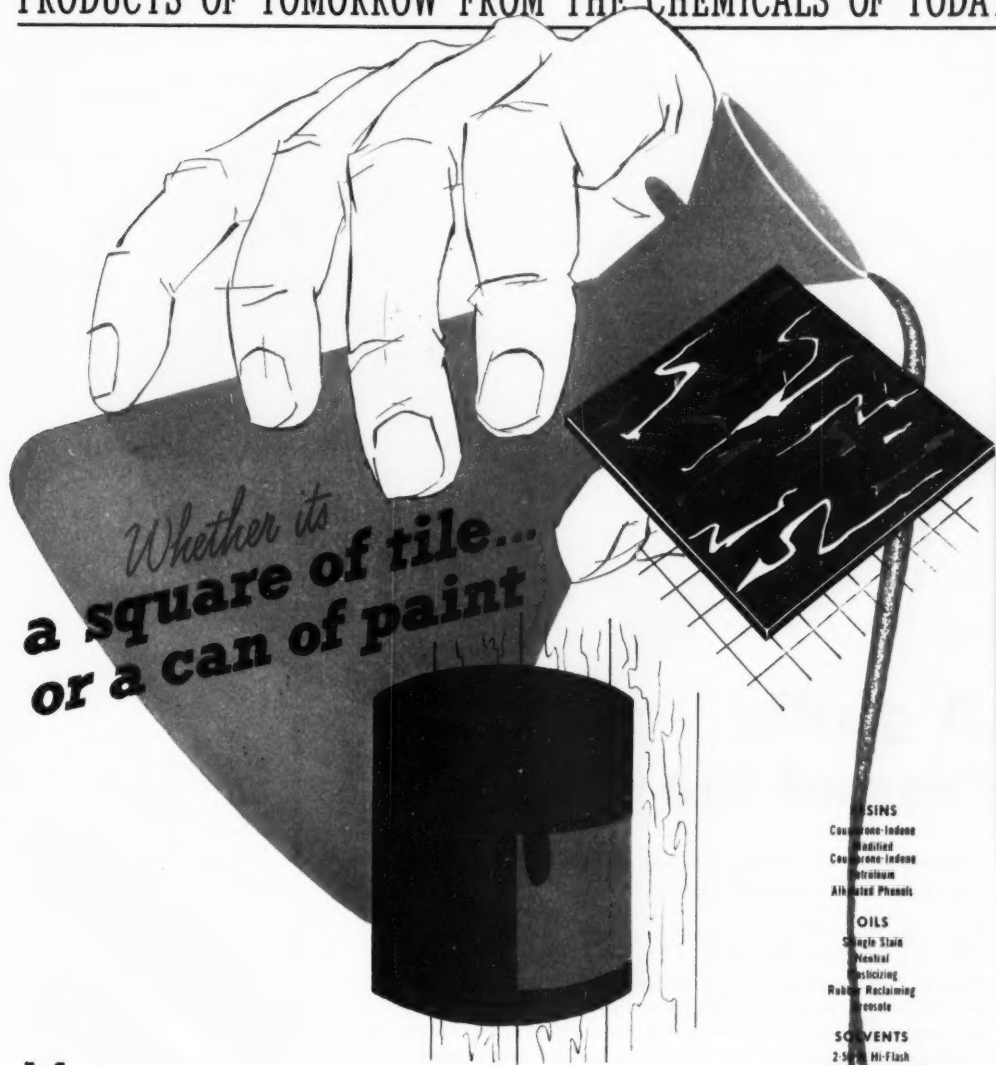
Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• The Nation's Headquarters for Brass & Copper

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver†	Minneapolis	Pittsburgh	Waterbury
Boston	Detroit	Providence	Richmond†	(Yales office only)
Chicago	Houston†	Newark	St. Louis	
Cincinnati	Indianapolis	New Orleans		

PRODUCTS OF TOMORROW FROM THE CHEMICALS OF TODAY



MASTIC floor tile must withstand wear. And so must paint. Each, of course, has different characteristics, but both have one thing in common . . . Neville Chemicals. The Neville line is designed for hundreds of varied applications in Industry! You are almost sure to find a Neville product that will be best for your specific problems.

Tell us your particular need . . . we'll help you select the right Neville chemical for your purpose.

THE NEVILLE COMPANY • PITTSBURGH 25, PA.

Plants at Neville Island, Pa., and Anaheim, Cal.



RESINS
Cumene-Indene
Modified
Cumene-Indene
Polystyrene
Alkylated Phenols

OILS
Single Stage
Neutral
Resinizing
Rubber Reclaiming
Grease

SOLVENTS
2-5% Hi-Flash
Crude & Refined Coal-Tar
Wire & Metal Thinners

SPECIALTIES
Phenolazine
Rubber Compounding
Materials
Tar Pails



A girdle 'round the globe

The total length of G-R Finned Tubing that has been furnished for heaters, coolers, condensers and heat exchangers would circle the world.

More than 70,000 Twin G-Fin Sections . . . just one of the many types of G-R Finned Tube Units . . . have been installed, serving the broadest range of applications of any heat transfer apparatus on the market. Many thousands of K-Fin Air and Gas Coolers have been built for stationary plants and shipboard. For more than 30 years, G-R Finned Tubing of various designs has been widely used for heat transfer apparatus ranging from tubular units to open sections.

Thus, each design of G-R Finned Tubing has given complete proof of its effectiveness and also its durability. Investigate the applications of these time-proven heat transfer elements for *your* plant, particularly for handling viscous liquids and gases. Write for bulletin describing their features and uses, and the types of exchangers for which they can be furnished.

G-R G-Fin Longitudinally-finned Tubing . . . specially adapted to transfer of heat to and from liquids of higher viscosity than water.



G-R K-Fin Helically-finned Tubing . . . specially adapted to transfer of heat to and from vapors and gases.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R
HEAT TRANSFER APPARATUS

Finned Tubing



GR 203

Hooker Chemical Guide (ONE OF A SERIES)

USE this handy reference to save time
in selecting high quality chemicals.

HOOKER SULFIDES

SODIUM SULFIDE

Formula: Na_2S

Appearance: Light, buff colored solid
in flake form

TYPICAL PROPERTIES

Molecular Weight	78.1
Melting Point	100° C
Na_2S	60-62%
Water of Crystallization	35% min.
NaCl	1.5% max.
Other Na Salts	2.0% max.
Fe	8 ppm max.
Other Heavy Metals	1 ppm max.

USES

Dehairing Agent: Hides
Desulfurizing Agent: Viscose rayon
Intermediate: Chemicals, dyestuff intermediates
Metal Processing: Ore flotation, metal refining
Other Uses: Manufacturing paper pulp, rubber; textile processing.

SODIUM SULFHYDRATE

Synonym: Sodium Hydrosulfide

Formula: NaSH

Appearance: Light lemon colored solid
in flake form

TYPICAL PROPERTIES

Molecular Weight	56.1
Melting Point	55° C
NaHS	70 to 72%
Water of Crystallization	26% min.
Na_2S	2.5% max.
Other Na Salts	1.2% max.
Fe	5 ppm max.
Other Heavy Metals	1 ppm max.

USES

Dehairing Agent: Hides
Desulfurizing Agent: Viscose rayon
Intermediate: Dyestuffs; organic chemicals such as thioamides, thiourea, thioglycolic acid, thio- and dithiobenzoic acids, sodium thiosulfate.

SODIUM TETRASULFIDE SOLUTION

Formula: Na_2S_4

Appearance: Clear, dark red aqueous
solution

TYPICAL PROPERTIES

Molecular Weight	174.2
Freezing Range	3.5° to -17° C
Distillation Range	115° to 120° C
Specific Gravity, 15.5°/15.5° C	1.335
Na_2S_4	40%
Sulfur	30%

USES

Soaking Agent: Hides and skins prior to unhairing
Reducing Agent: For organic nitro bodies
Reagent: Ore flotation
Intermediate: Sulfur dyes

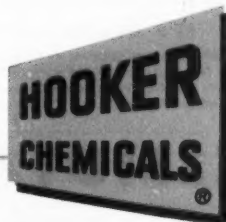
For detailed information on items listed, drop us a note
on your letterhead. Address your request to HOOKER
ELECTROCHEMICAL COMPANY, 15 Forty-Seventh Street,
Niagara Falls, N. Y.

HOOKER ELECTROCHEMICAL COMPANY

NIAGARA FALLS, N. Y. • NEW YORK, N. Y.

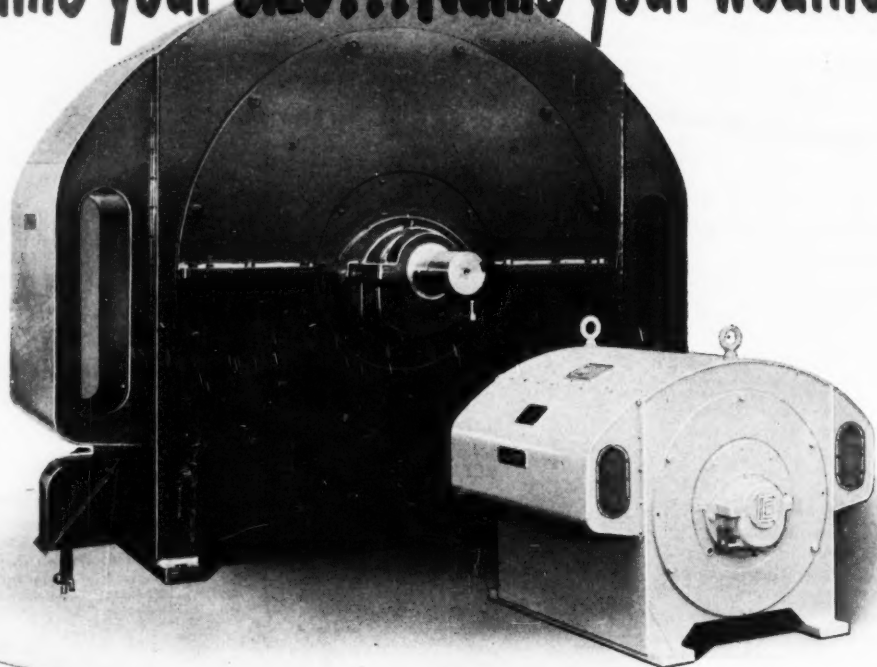
TACOMA, WASH. • CHICAGO, ILL. • WILMINGTON, CALIF.

From the Salt of the Earth



2-325

Name your size...Name your weather!



ELLIOTT OUTDOOR SPLASHPROOF ... the motor that needs no roof!



IT'S DELUGE-PROOF!

Elliott outdoor splashproof motor undergoing operating test under torrents of water, going strong after hours of deluge. When disassembled, windings were found completely dry.

IN ANY CAPACITY you need, ranging from 150 hp to 3000 hp and even higher, as graphically shown in the illustration above.

FOR ANY CLIMATE from salt fog, raging blizzard, torrential rain to dry dust storm.

THIS IS THE MOTOR that is broadening horizons for plant designers... simplifying installations... reducing piping layouts... eliminating housing costs. For this motor has its own house, in a welded steel enclosure that *without the need for special foundation or duct work*, admits ventilating air alone, excluding air-borne rain, snow, sleet, dust or debris. The bulletin gives complete data. Contact your local Elliott representative, or write Elliott Company, Ridgway, Pa.

ELLIOTT Company

R2-17

RIDGWAY DIVISION

ELLIOTT ELECTRICAL EQUIPMENT INCLUDES
CROCKER-WHEELER INDUSTRIAL MOTORS



**Pardon My
Ignorance**
by Pinet



*I thought A CATALYST SUPPORT was a crutch for a
tottering tom . . . until I got the facts from Norton*

Now I Know:

A catalyst support, to more and more processing firms, means Norton ALUNDUM® spheres, rings or pellets of such purity and chemical stability that they assure end products free from contamination. Their patented controlled structure, high refractoriness and abrasion-resistance promise you greater yields over a longer service life.

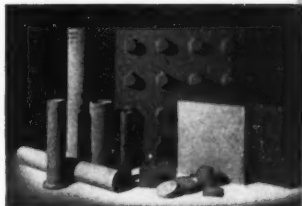
In particular, it may pay you to investigate Norton spherical catalyst supports. Made in diameters from $\frac{1}{4}$ " to $\frac{3}{4}$ ", they provide you with such a uniform bed that channelling and pressure drop are reduced to a minimum.

Continuing research in catalyst supports is typical of the efforts Norton engineers are making to fit special refractories to your exact requirements.

So, if you have a high-temperature problem, complicated by chemical, electrical or physical variables, call in your nearby Norton refractories engineer. Or write to Norton Company, Refractories Division, 510 New Bond Street, Worcester 6, Massachusetts, Canadian representative: A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.



NORTON CATALYST SUPPORTS can be supplied in CRYSTOLON®, MAGNORITE®, FUSED STABILIZED ZIRCONIA and MULLITE, as well as in ALUNDUM, compositions. Each has its own special properties as a catalyst support. Each has the chemical stability and purity that eliminate contamination of both catalyst and end product.

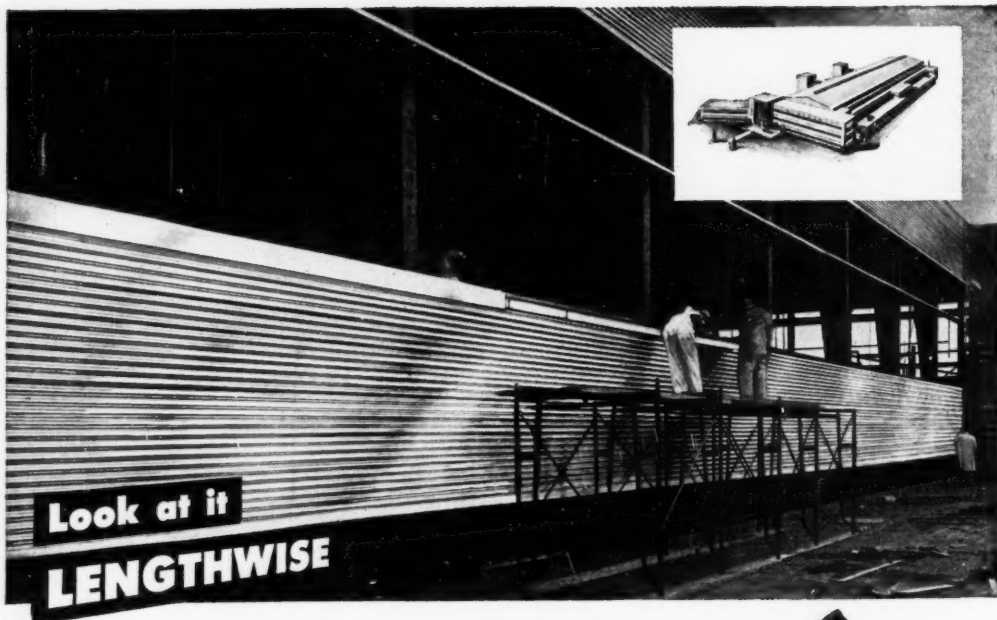


NORTON POROUS MEDIUMS are made of ALUNDUM (fused alumina) in a wide range of sizes and shapes in plates, tubes, discs, and diaphragms for filtration, diffusion, aeration and electro-chemical applications. Patented controlled structure makes them uniformly porous. Highly resistant to acid and alkaline conditions.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

Special REFRACTORIES
Making better products to make other products better
NORTON COMPANY, WORCESTER 6, MASSACHUSETTS



**Look at it
LENGTHWISE**

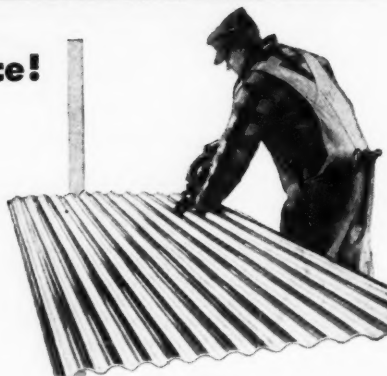
... Longer Life, Lower Maintenance!

When Hytron, Division of CBS, planned its new Danvers, Mass., plant, architects and clients agreed on Reynolds *Lifetime* Aluminum Industrial Corrugated for siding. Low initial cost, long life and lowest maintenance were practical factors. But the architects—R. P. Systems Engineers—sought a design effect, too. So they specified *horizontal* application. General contractor was L. R. Porter Construction Company.

Both as siding and as roofing (vertically applied) this material saves substantially on labor costs. It is light weight, easy to handle... workmen like it. In addition, aluminum reflects radiant heat... keeps interiors up to 15° cooler in summer and warmer in winter.

Plan your next construction with this high-strength aluminum that never rusts, resists corrosion.

Call Reynolds for literature and technical assistance... offices in principal cities. Check your classified phone book for our listing under "Building Materials," or write to Reynolds Metals Company, Building Products Division, 2042 South Ninth Street, Louisville 1, Kentucky.



Specifications:

Thickness .032"

Weight 56 lbs. per square

Corrugations 7/8" deep, 2-2/3" crown to crown

Roofing width 35", coverage 32"

Siding width 33-3/4", coverage 32"

Lengths 5', 6', 7', 9', 10', 11', 12'

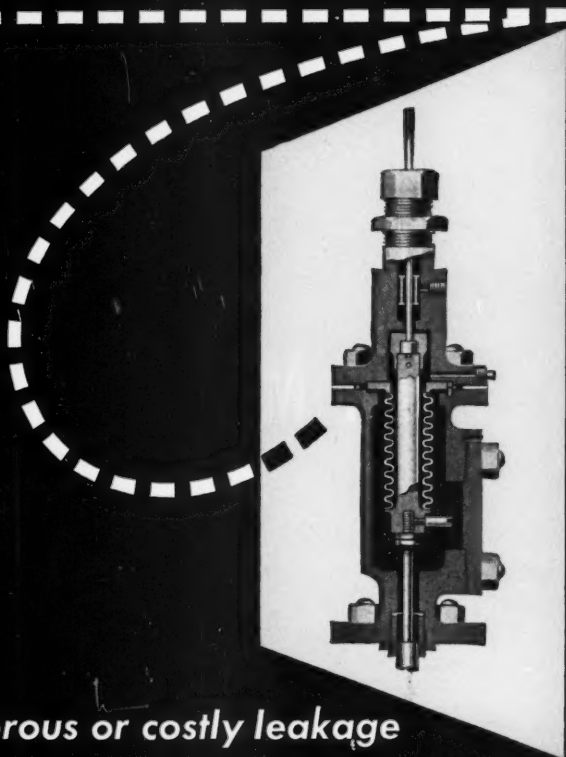


Military demands for aluminum limit supply, but Reynolds is rapidly expanding aluminum capacity. Rated orders receive priority handling.

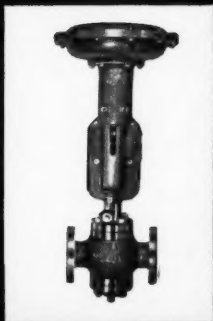
REYNOLDS *Lifetime* ALUMINUM INDUSTRIAL CORRUGATED



POSITIVE PROTECTION . . .



prevents dangerous or costly leakage



The bellows seal of the Honeywell Series 700 Valve is a metal barrier which insures against loss of valuable or dangerous fluids . . . cannot buckle or twist . . . is precision-machined . . . takes pressures up to 600 pounds. The Honeywell Series 700 wide band proportional control valve comes in a full range of styles and sizes . . . has *all* the features you look for in a fine valve. Write today for your copy of Bulletin 700-2.

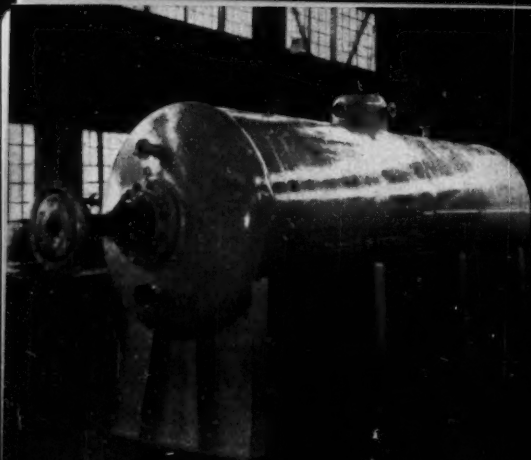
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1904 Windrim Avenue, Philadelphia 44, Pa.

Honeywell

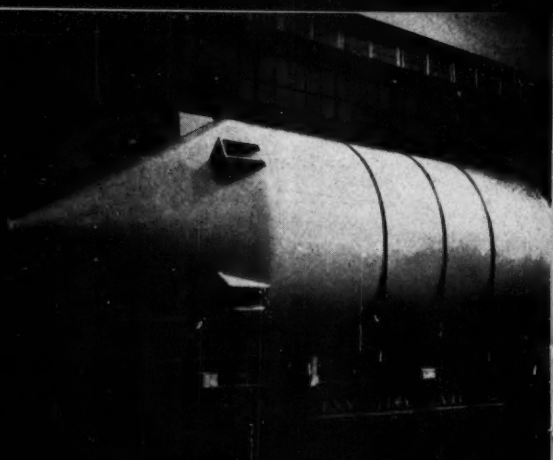
VALVE PRODUCTS



First in Controls



DEVULCANIZER



SULPHATE DIGESTER

Our Manufacturing Facilities

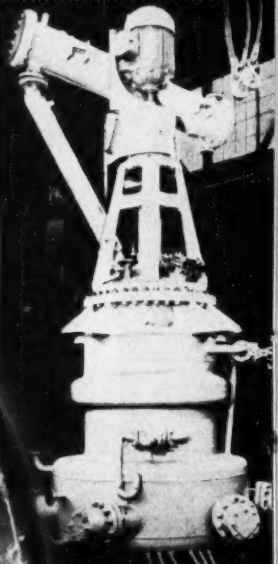
TUMBLING DIGESTER, 10' x 28 6" 150 PSI



VERTICAL AUTOCLAVE

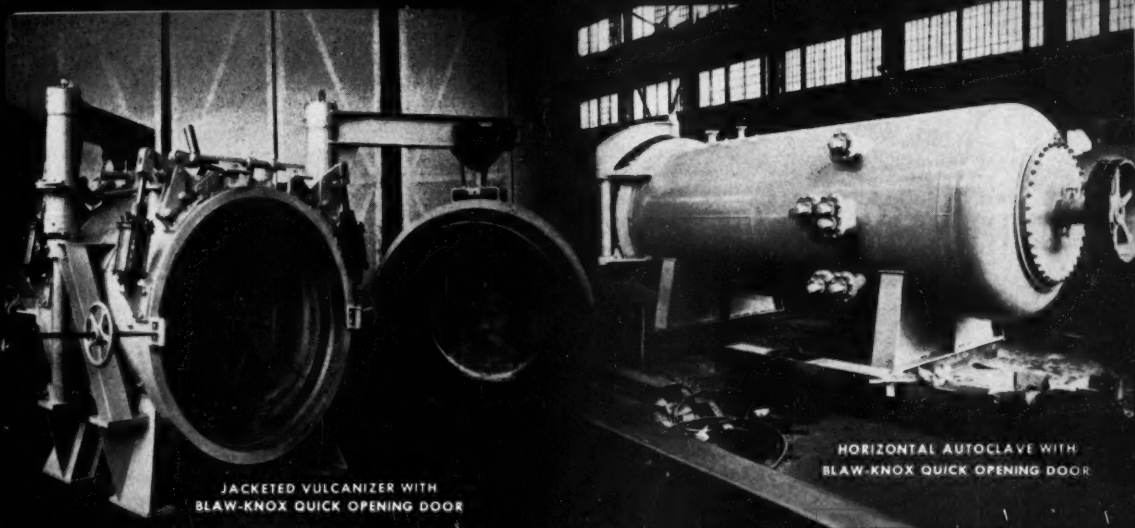


ELECTRO-VAPOR
RESIN KETTLE AND CONDENSER



LEAD KETTLE





JACKETED VULCANIZER WITH
BLAW-KNOX QUICK OPENING DOOR

HORIZONTAL AUTOCLAVE WITH
BLAW-KNOX QUICK OPENING DOOR

IMPROVED to meet all modern needs!

EXTENSIVE modernization of plant and procedures enables us to build virtually any type or size of processing equipment to fulfill your requirements. Improvements include new equipment for rolling and shaping larger, heavier sheets and plates, improved X-ray equipment and new tooling throughout our shops. High-quality Blaw-Knox Process Equipment now costs no more than ordinary equipment. Take advantage of Blaw-Knox years and years of successful experience in serving the processing industries . . . for complete information write for Bulletin 2403.

Process Equipment Department

BLAW-KNOX DIVISION of Blaw-Knox Company

2076 Farmers Bank Bldg., Pittsburgh 22, Pa.

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HIGH QUALITY EQUIPMENT FOR:

Distillation • Cracking
Gas Cleaning
Solvent Extraction
Solvent Recovery
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High Pressure Processing

BLAW-KNOX PROCESS EQUIPMENT

PYREX® brand "Double-Tough" glass pipe gives Berkeley Chemical Corporation* great processing flexibility

**Corrosion resistance, visibility,
ease of cleaning and assembly important
to economical production**

BECAUSE of the variety of chemical products handled, Berkeley Chemical Corp., Berkeley Heights, N. J., has long recognized the fact that only glass would withstand its more corrosive materials, provide the visibility necessary to check processes continuously, provide ease of cleaning, and make frequent rearrangements of condenser and

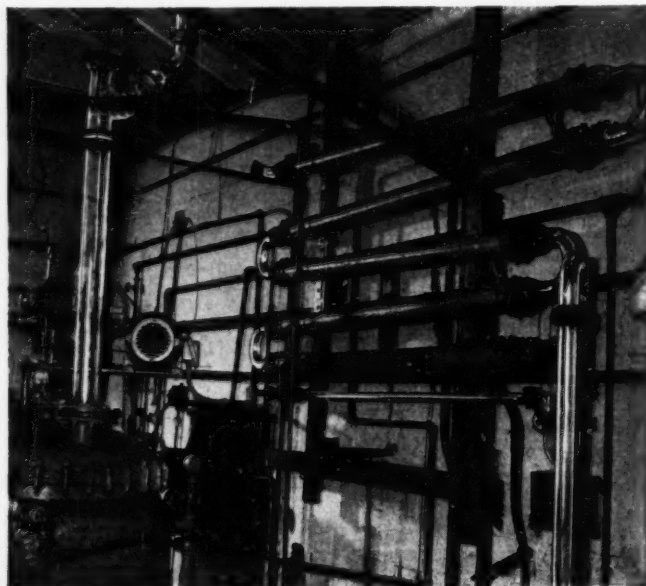
gravity separator elements a simple matter.

The raw materials handled include organic acids and three notorious corroding agents — iodine, chlorine, and bromine. Solvents used in the various processes include sulfuric and hydrochloric acids, benzene, toluene, chloroform, alcohol, xylene, acetone and, at the far

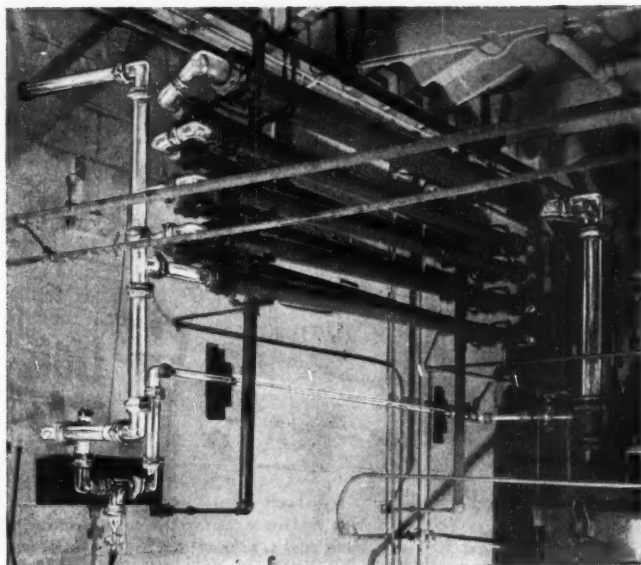
end of the scale, a variety of caustics.

Dr. Sidney Beinfest, Vice President of Berkeley, says that "PYREX pipe and heat exchanger glass is not affected by anything the company has ever put through them. In fact, the use of glass makes practical the processing of any probable combination of chemicals in the pharmaceutical and intermediate fields. The effect of this single fact makes the company confidently willing to tackle anything within the reach of its sales organization — Millmaster Chemical Corp."

*An affiliate of Millmaster Chemical Corp.



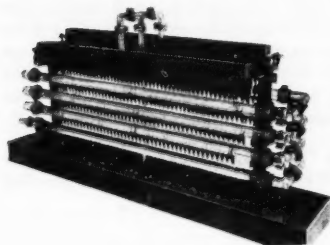
This picture shows a glass air condenser connected to the reaction kettle for an iodination process. Iodine which crystallizes on the wall of the vertical 4" glass tube is recovered and returned to the process. On the wall to the right is a specially designed jacketed PYREX water-cooled condenser made of 2" pipe and U-bends. Change over to the wet condenser can be made in 20 to 30 minutes. Mike Zelkind, Production Engineer, stated that most of the U-bends and all of the pipe in this condenser are over 5 years old. Mechanical failure has averaged one in two years, and that was due to lack of flexibility in the wall mounting.



The specially designed condenser shown in the top center of this picture includes a top run of 4" x 10' PYREX heat exchanger tubing, and 8 2-inch diameter PYREX tubes. Jackets are stock pieces of black iron pipe. Standard PYREX stuffing boxes make the seals. Note that instead of U-bends at the ends of the

tubes, connections are formed of 2" PYREX 90° elbows to increase flexibility. Note also the loose-hung suspension system of this unit for protection against vibration. Gaskets are Teflon. To date the only maintenance has been occasional gasket replacement. Gasket replacement takes "less than 5 minutes."

PYREX brand Cascade Coolers . . . the efficient, economical way to cool corrosives



IN practically every application involving the cooling or condensing of corrosive liquids, standard

PYREX brand cascade coolers will provide the efficient, economical solution. Exceptionally resistant to virtually all acids, they assure long service life and protect sensitive products. Further economies result from the use of low-cost river or sea water as a coolant.

Low in first cost per BTU transferred, they also cost less to clean and maintain. Unusual versatility of mounting on walls, floor and ceiling saves space. And you get maximum heat transfer through thin but sturdy walls.

The PYREX pipe distributors listed below carry the complete line
Contact the one nearest you:

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Glass Engineering Laboratories

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Valley Fdy. & Mach. Works

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Macalaster Bicknell Company

ATLANTA, GEORGIA
Southern Scientific Company

CHICAGO 44, ILLINOIS
Fred S. Hickey, Inc.

NEW ORLEANS, LOUISIANA
W. H. Curtin & Company

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Macalaster Bicknell Company

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CORNING GLASS WORKS Dept. CE-10, Corning, N. Y.

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- ☐ "PYREX brand Glass Pipe in the Process Industries" (EA-1)
☐ "PYREX brand "Double-Tough" Glass Pipe and Fittings" (EA-3)
☐ "PYREX Cascade Coolers" (PE-8)

Name

Title

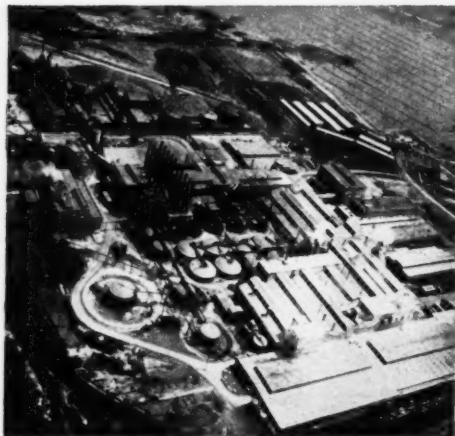
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Precipitator at
NATIONAL LEAD COMPANY



This Cottrell, which recovers 95% of the sulphuric acid mist from absorber exit gases, is the 23rd Research Corporation installation in the plants of the National Lead Company. In 1935, this company placed its first order for a Cottrell Electrical Precipitator. Today, 12 Cottrells are on the line in Sayreville, N. J. and 11 in the St. Louis plant.

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THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers — and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.



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October 1952—CHEMICAL ENGINEERING



How to Work at
FULL TILT
and lose less than ever!



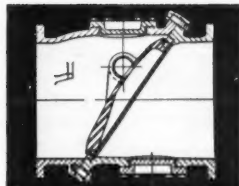
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Take another look at the diagram below. That tilting disc actually *balances as it closes* . . . so that it cushions itself into a drop-tight seat . . . without any slamming under usual piping arrangements.

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THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASSACHUSETTS



Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

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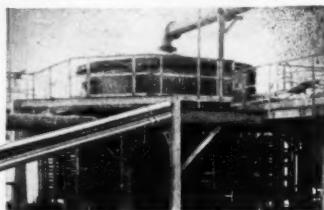
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used in Simonson-Mantius concentrator for H_2SO_4 recovery. More than 250 bayonet heaters have been made for this use. The first, installed in 1945, is still in service.



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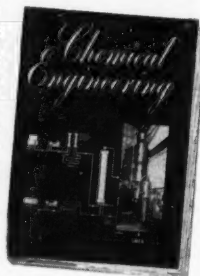
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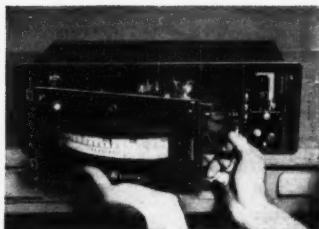
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K10-52



G-E Pyrometer Equipment Quick and Easy to Inspect, Maintain

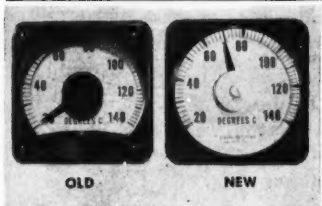
Routine inspections of new General Electric Type HP pyrometers can quickly be made. Besides making preventative maintenance easy, this equipment has many other features to provide accurate indication and temperature control of furnaces, ovens kilns, and other industrial heating equipment.

ACCURATE WITHIN $\frac{3}{4}$ OF 1% full scale, HP-3 pyrometers have automatic cold-junction compensation that adjusts for changes in ambient temperature.

Any change in temperature, even as small as 0.1% full scale, starts immediate control action. Normal changes in humidity, ambient, and voltage have little or no effect on the exactness of control action.

FOUR TYPES AVAILABLE—indicating, protecting, two- and three-position control forms; also both flush and surface mountings. All available in a variety of temperature ranges in the 0-3000 F span.

Mail the coupon for complete information about Type HP pyrometers.



New Shadow-proof Temperature Indicators Are Easier to Read

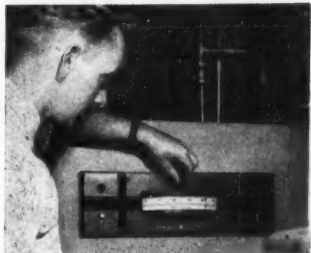
Temperatures from -100 F to $+300$ F can now be accurately indicated and controlled with General Electric's new line of temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available— $4\frac{1}{4}$ - and $8\frac{3}{4}$ -inches. Check coupon.

New Resistance Thermometers Accurately Indicate and Control Low Temperatures

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NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the -100 F to $+300$ F range. You can buy four types of resistance



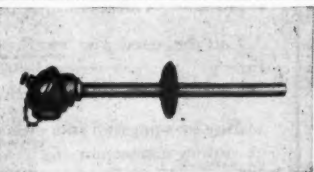
thermometers—indicators, protectors, and two- or three-position controllers—for either flush or surface mounting.

For complete information, mail the coupon below.



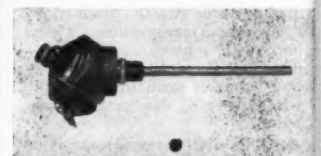
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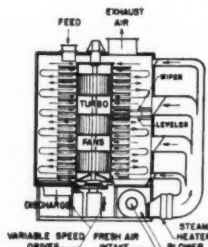
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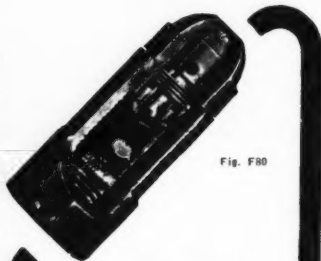


Fig. F80

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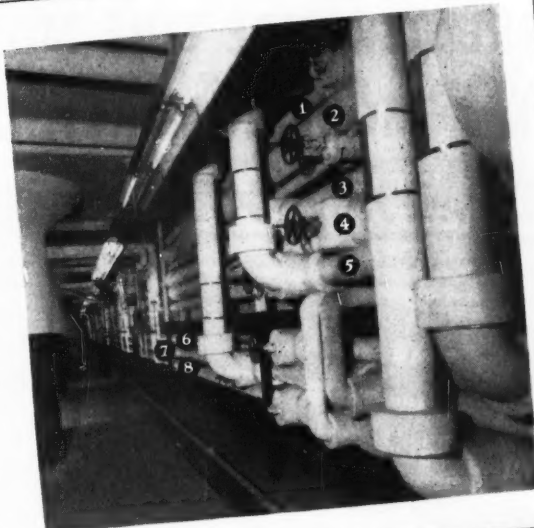
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Std. Thick 85% Magnesia
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Dbl. Std. 85% Magnesia
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Light-Duty Cork Covering
- ④ 4" 40° water supply
Light-Duty Cork Covering
- ⑤ 4" 200° water return
Std. Thick 85% Magnesia
- ⑥ 4" 200° water supply
Std. Thick 85% Magnesia
- ⑦ 4" 200° water return
Std. Thick 85% Magnesia
- ⑧ 4" 200° water supply
Std. Thick 85% Magnesia



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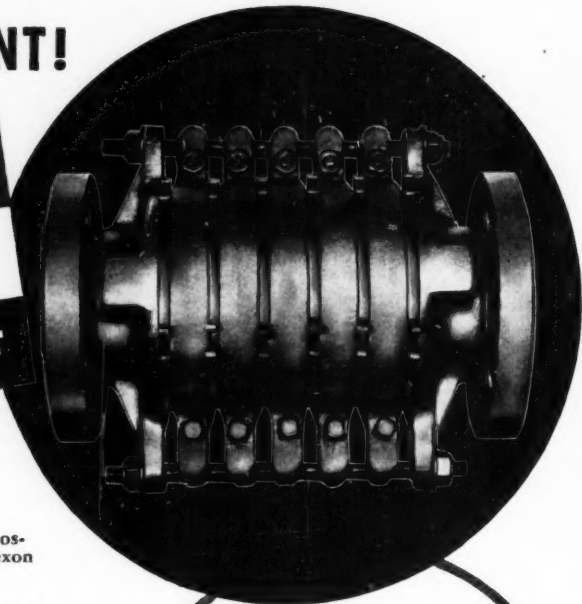
The next time you're in the market for heat insulation work, get in touch with Armstrong Cork Company. We can help you engineer the job, as well as supply good insulating materials and experienced workmen to apply them. Just contact your near-by Armstrong Office or write today to Armstrong Cork Company, 3310 Maple Avenue, Lancaster, Pennsylvania.



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For temperatures up to 2800° F.

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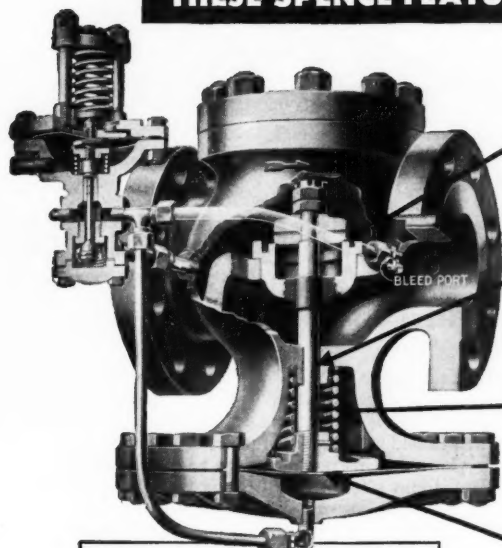


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SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS—Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

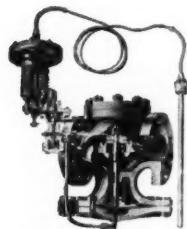
PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM—The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

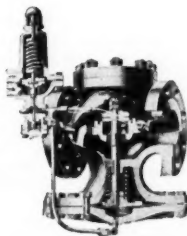
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

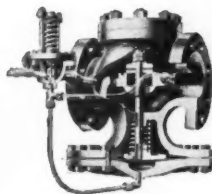
Spence Pressure and Temperature Regulators are built in sizes from $\frac{1}{4}$ " to 12" for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator—Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

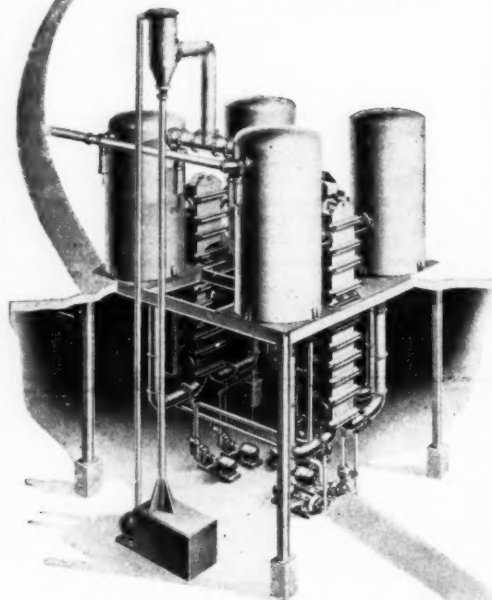
SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

Conkey Flat Plate Evaporators with Rosenblad Switching System*

Completely self-cleaning during operation

No down time! No scale removal costs!



Conkey 4-Body Triple Effect Flat
Plate Heating Surface Evaporator

Take a leaf from the flow sheets of another industry. For years evaporation of spent sulphite pulp cooking liquors in sulphite pulp manufacture was considered highly impractical because a gypsum coating developed on heating surfaces. But today—it can be a *continuous, full capacity self-cleaning operation* through use of Conkey Evaporators and Rosenblad Channel Switching System.

The advantages of the Rosenblad Channel Switching System have been thoroughly proven both in this country and abroad. Heating surfaces, interconnecting pipe and pump systems are *completely cleaned during normal operation!* It's especially effective wherever lime salts scale evaporators.

Conkey equipment adapts itself well to channel switching for self-cleaning operation while providing all the other advantages of multiple effect evaporation: forced circulation . . . falling film . . . recompression . . . thermal compression . . . high vacuum and other specialized benefits where required.

*Patents Applied For

PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRANSPORTATION CORPORATION

Sales Offices: 10 East 49th Street, New York 17, New York
General Offices: 135 South LaSalle Street, Chicago 90, Illinois

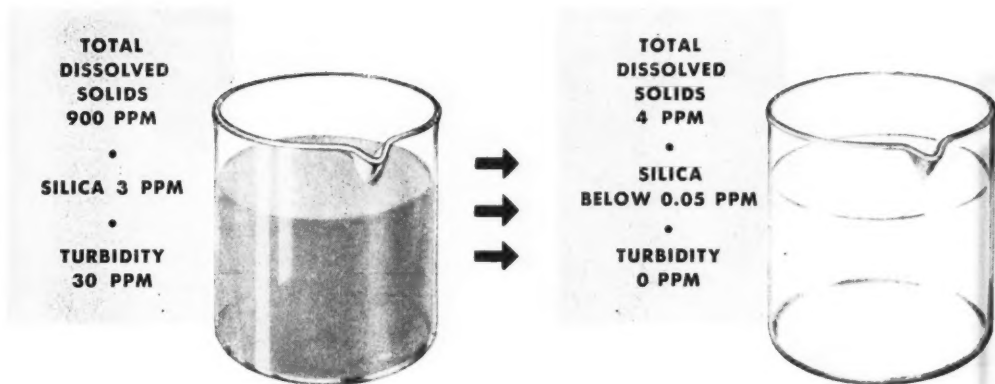
Sole licensee in the U. S. A. for the
A. B. Rosenblads Patented Evaporator Switching System.
OFFICES IN ALL PRINCIPAL CITIES



GET THE FULL DETAILS. Write today for new bulletin. See how a Conkey Evaporator with Rosenblad Switching System can eliminate down time, eliminate scale removal costs and keep a constant flow sheet for you.

Other General American Equipment: Turbo-Mixers, Filters, Dewaterers, Dryers, Towers, Tanks, Bins, Pressure Vessels.

A Graver Demineralizer makes the difference

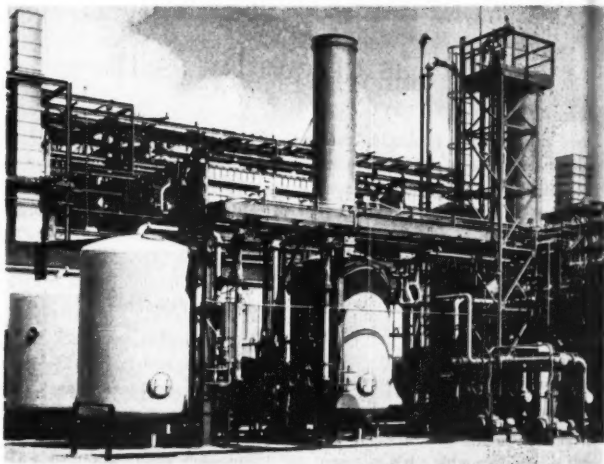


This Graver demineralizer installation had to tackle a *doubly* tough water purification problem . . . extreme hardness plus turbidity. And 600 gpm has to be treated.

But the Graver plant is combining demineralizing plus filtering of this large demand with complete success. In addition, a Graver Vacuum Deaerator following the Demineralizer completely eliminates CO₂ and reduces the oxygen below 0.2 ppm. As a result, the effluent is ideally suited for the high pressure boilers served by the Graver installation.

For similar success in solving *your* water treatment problem, investigate Graver's proven modern equipment designs based on over 40 years of specialized experience and pioneering in every water treating process.

Your request for recommendations will involve no obligation.



Double train, two-bed Graver Demineralizer installation at a large southwestern chemical plant, treating 864,000 gallons per day of raw water for 450,000 pounds per hour, 1250 psig boilers.

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

DEPT. CE-D, 216 WEST 14TH STREET, NEW YORK 11, N. Y.

In Canada: The Bird-Archer Co., Ltd.; Cobourg, Ontario

In Mexico: Proveedores Tecnicos, S.A.; Puebla 259, Mexico 7, D. F.





Photo courtesy of The Dow Chemical Company, showing standard method of packaging samples for mailing.

Are your chemicals packaged as efficiently as these?

Does your present packaging method provide just the *right amount* of protection for your chemicals or chemical products? Is your packaging operation fast, easy—*economical*? As the illustrations show, these companies found a *common sense* answer in Kimberly-Clark Interior Packaging —KIMPAK*. A modern cushioning material of unlimited versatility that could be "tailored" to fit their specific needs.

Available in rolls, sheets or pads in many thicknesses, KIMPAK is soft, clean, comfortable. It's pleasant to handle, non-irritating, and easy to ap-

ply as wrapping paper. KIMPAK is *light*—to save on shipping costs—yet efficiently *cushions* the product against shipping hazards. It absorbs up to 16 times its own weight in moisture within 30 seconds, to comply with Parcel Post regulations covering shipments of liquids.

So whether you package powders, capsules, tablets, granules—liquids in bottles, jars, tubes, vials or ampoules—KIMPAK can answer *your* specific needs, too, at lowest true cost. For complete information, write Dpt. 0-10, Kimberly-Clark Corp., Neenah, Wis.



A Product of
Kimberly-Clark



Photo courtesy of Tylon Products Corp. Tylo, a detergent in tablet form for dishwashing.

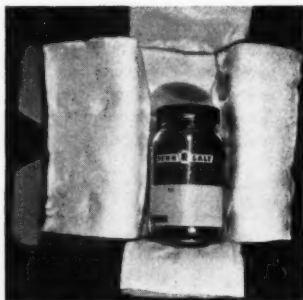


Photo courtesy of Pennsylvania Salt Manufacturing Co. A chemical in granular form.

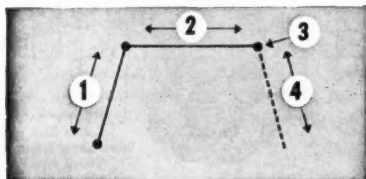
* U. S. REG. U. S. & FOREIGN COUNTRIES

If You're Batch-Cooking You Can Use This Inexpensive Control



Here is a recorder-controller planned especially for economically controlling processes like batch cooking. The Gotham Elapsed Time Recorder-Controller does the essential control jobs easily and accurately. First of all, it brings the batch up to maximum holding temperature fast. It holds the batch at that temperature for a predetermined period. It shuts down the process at the end of the cooking period. Those are its three standard functions. Automatic venting or cooling functions can be added. Also available with a pressure, instead of temperature, system.

Write for full information about the Elapsed Time Recorder-Controller and other Gotham Controllers. They're in Catalog 500.



This Is What the Gotham Elapsed Time Recorder-Controller Does

1. Brings controlled variable (temperature or pressure) up to maximum fast.
2. Holds variable at maximum for predetermined period.
3. Shuts down process.
4. Automatic venting or cooling can be added.



Gotham Elapsed Time Recorder-Controller

SPECIFICATIONS

CHART SIZE: 12"

CASE: Standard - black crinkle; smooth black or white may be obtained.

ACTUATION: Vapor, Gas or Mercury for temperature. Pressure elements available.

CHART DRIVE: Spring wound or synchronous motor.

CONTROL SYSTEM: Pilot relay with adjustable sensitivity for 0 to 30% throttling band is standard, two position or 100% throttling band available.

HOLDING PERIOD: Standard 0 to 3 hrs. Other periods available.



Keep Everything Under Control
With Gotham

INSTRUMENTS

Division of AMERICAN MACHINE AND METALS, INC.

Dept. 9, 233 Broadway, New York 12, New York

You've got a Winning Combination



DOUBLE SEATED DIAPHRAGM CONTROL VALVES

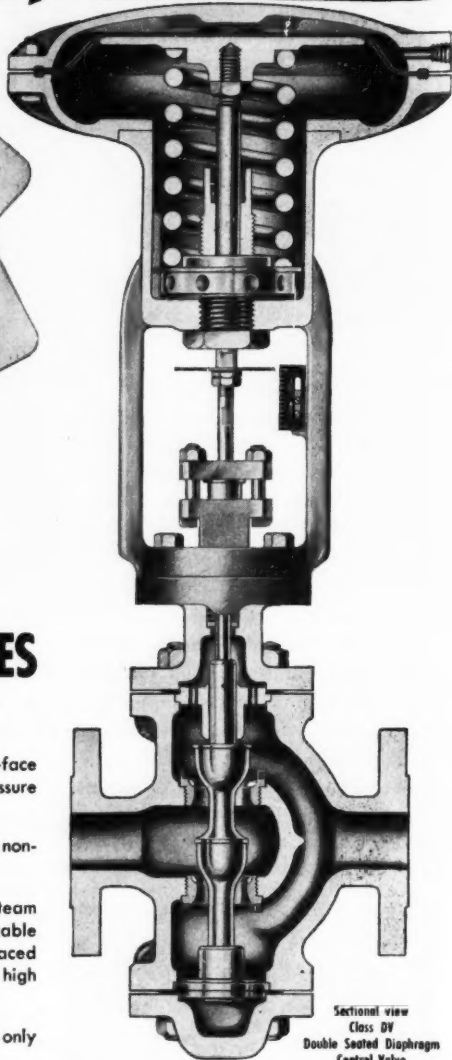
Calling a spade a spade you've got a "royal flush" of features in these new Valves designed for use with control instruments.

Their "Flow-Line" Contoured Bodies have ISA standard face-to-face dimensions and high capacity, low turbulence and minimum body pressure drop characteristics.

A new type, top and bottom guided construction is self-aligning and non-binding regardless of unevenness of bolt tightening.

Standard, integral stellitized seating surfaces are recommended for steam service to reduce seat ring thread corrosion. Renewable, interchangeable seat rings also furnished where desired and may be easily replaced without removing valve body from the line. Elaborate grinding at high temperatures is completely eliminated.

With these Valves, you get as standard equipment, features heretofore only obtainable in expensive, specially designed valves.



Sectional view
Class DV
Double Seated Diaphragm
Control Valve

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

Albany, N. Y.	Chicago, Ill.	Galveston, Tex.	Memphis, Tenn.	Orlando, Fla.	Salt Lake City, Utah
Albuquerque, N. M.	Cincinnati, Ohio	Greenville, S. C.	Miami Springs, Fla.	Philadelphia, Pa.	San Francisco, Calif.
Atlanta, Ga.	Cleveland, Ohio	Houston, Texas	Minneapolis, Minn.	Pittsburgh, Pa.	Seattle, Wash.
Baltimore, Md.	Dallas, Texas	Indianapolis, Ind.	Mobile, Ala.	Ponca City, Okla.	St. Louis, Mo.
Beaumont, Tex.	Denver, Colo.	Kansas City, Mo.	Monroe, La.	Providence, R. I.	Syracuse, N. Y.
Birmingham, Ala.	Des Moines, Ia.	Kingsport, Tenn.	New Orleans, La.	Richmond, Va.	Tucson, Ariz.
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279 Grant Avenue, Lyndhurst, New Jersey

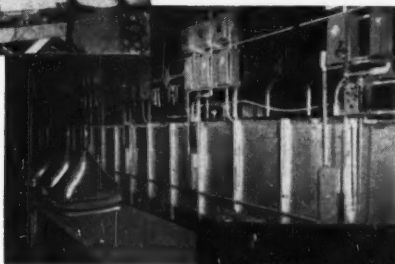
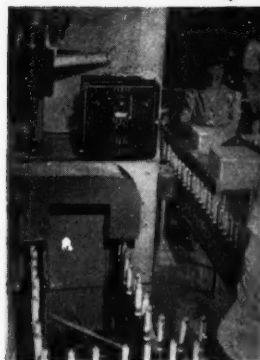
WRITE FOR Bulletin 513



1707

FLOATLESS LEVEL CONTROLS
SELF CLEANING STRAINERS

PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
PUMP GOVERNORS • TEMPERATURE REGULATORS
AIR HORNS • STEAM WHISTLES



1. Electromax controlling low-temperature oven for drying collapsible tubes.
2. Salt pots operate at 400 F under Electromax control.
3. Electromax controlled oven for annealing TV tubes.
4. Mounted on injection-molding machine, Electromax controller withstands vibration.

IS THIS THE Inexpensive Electronic Controller YOU'VE BEEN LOOKING FOR?



• For many processes and operations where close temperature control has long seemed impractical, this Electromax instrument is the answer. It is "made to order" for places where a temperature record is not warranted. It is ideally suited for rugged process conditions. With Electromax you can afford the advantages of quality automatic temperature control for virtually every process with temperatures to 1000 F.

Initially inexpensive, this instrument is also economical to operate. It requires surprisingly little maintenance because it has only one part that moves—a hermetically sealed plug-in-

relay. When new vacuum tubes are needed, they can be obtained at any radio store.

Electromax completely integrated control system includes the right combination of:

1. A highly sensitive, long-lived THERMOHM primary element for detecting the process temperature.
2. ELECTROMAX SIGNALLING CONTROLLER which indicates the temperature and automatically operates . . .
3. The CONTROL DEVICE required by the furnace, oven or other process equipment. This device may be a relay, contactor, solenoid-operated valve, motor-operated valve, air-operated valve, etc.

For further information about this controller write 4916 Stenton Ave. or contact our nearest office.

CAREER OPPORTUNITIES AT L&N

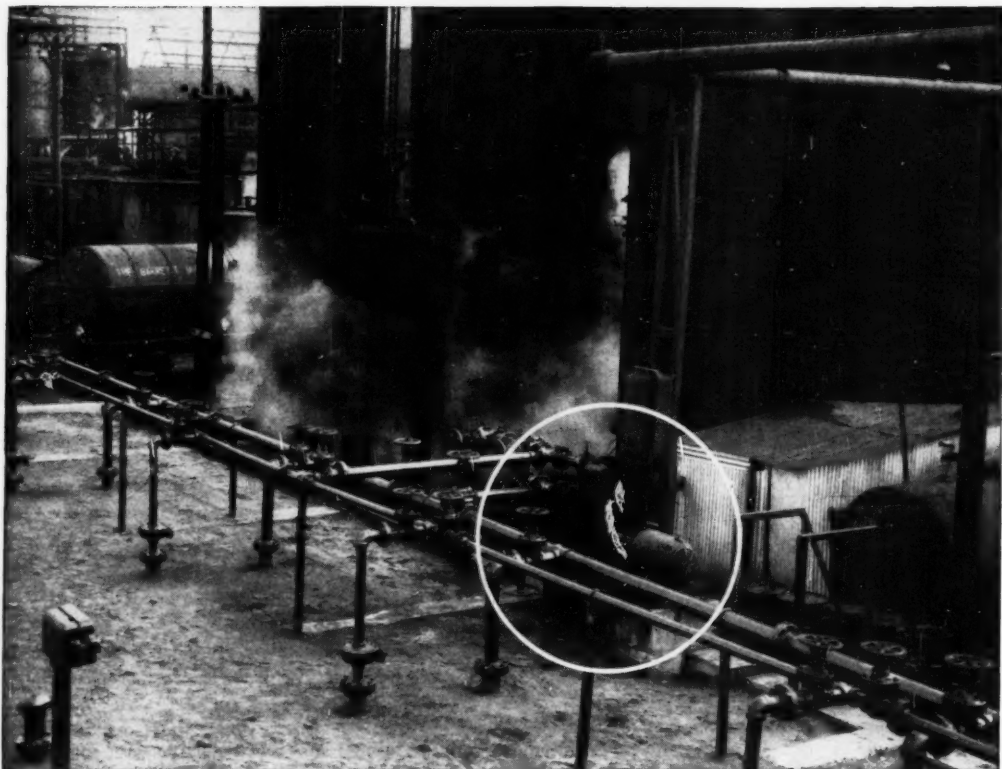
Expansion program of this long-established firm has many features to attract outstanding recent graduates in engineering and science. Opportunities are in sales field engineering, product and application engineering, research, advertising, market development. Widely-respected policies assure recognition of progress and achievement. Address Personnel Manager for preliminary interview at nearest of 17 L&N offices.

Jrl. Ad. ND47(8)

New 20 page Electromax catalog free upon request.



LEEDS & NORTHROP
Instruments automatic controls • furnaces



Air-Minded Engineering

The LaBour pump shown above is there because the engineers who planned this installation were air-minded. They had to be. The highly flexible piping plan, while it serves its purpose admirably, cannot avoid the introduction of large volumes of air into the system. The LaBour Type DPL handles the air along with the liquid without wasting any time.

The one pump moves coal tar solvents between tank car, storage tanks, and plant as required. Tanks are buried, sand insulated, so pumping is a suction-lift job, and prime is lost in valving from one tank to another.

Your pumping problem may be different, but your best answer is LaBour. It has been the best answer for thirty years.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR



THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U. S. A.

OLIVER **PRECOAT** FILTER



One of several 8'x10' Oliver Continuous Vacuum Precoat Filters in the big Lederle Laboratories, Pearl River, N. Y. This single division of American Cyanamid Company has eleven Precoats in its plant.

A Great Filter in a Great Field—Antibiotics!

Again Oliver United comes up with the engineering service and the right filter design for handling new and unexplored filtration problems. We refer to the various 'antibiotics' which are making great names for themselves in the field of medicine.

In several plants, on several different products, the Oliver Precoat Filter has proved to be a practical filter for handling the peculiar, almost unfilterable, solids produced in the various processes. The cakes formed are thin, sticky and flow-retarding yet the Precoats handle them effectively and economically. In some instances the Precoats are 'continuous vacuum'; in others, 'continuous pressure.' Either design, they sure are doing good work.

It may well be that your filtration problem doesn't call for an Oliver Precoat Filter (Bulletin 217). Whatever it requires, bear in mind that our engineers will bring to that problem 44 years of filtration experience and many types of filters involving all three classes: continuous vacuum, continuous pressure and batch pressure. We have complete testing facilities to help make the selection the right one for your requirements.

Another Oliver United filter that has already proved its worth in handling 'antibiotics' provides further evidence of Oliver United's broad service to industry. We refer to the Oliver Horizontal Filter. This filter rotates on a horizontal plane with full visibility of feeding, filtering, washing and cake discharging. It is ideal for handling crystalline or coarse products. Bulletin 218 gives the details.

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OLIVER UNITED FILTERS



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Choice of 7 Case Designs

WHEN YOU SPECIFY

ASHCROFT DURAGAUGES

SPECIFIC NEEDS are your best guide in selecting a pressure gauge casing. Ashcroft Duragauge Casings, made in three distinctly different types of material and seven different designs, meet practically every installation and service requirement:

ALUMALIFE®—a special aluminum alloy that is light, strong and has excellent overall resistance to corrosion and vibration.

CAST IRON—tough and durable. Used in corrosive conditions where aluminum would not be suitable.

PHENOL—light, strong, rigid plastic that is acid-proof and corrosion proof.

Every Duragauge case is dust and moisture-proof, and the entire gauge system

can be easily removed from the case as a unit.

To insure peak performance and maximum service life in specific installations, you can choose an Ashcroft Duragauge with the Bourden Tube made of any one of eight different types of materials. All provide unusually long tip travel, consequently greater accuracy of indication is assured. The patented Nylon Movement outwears all others. And the micrometer adjustment pointer is easy to get at and reset precisely while on the shaft.

Remember, only Ashcroft Duragauges give you all these advantages. So—ask the nearby Ashcroft Distributor to help you choose Duragauges that fit your needs exactly.

ASHCROFT DURAGAUGE CASE MATERIALS, MOUNTING AND DIAL SIZES

CASE	BACK FLANGE	MOUNTING		CONNECTION		DIAL SIZE
		WALL	FLUSH	LOWER	BACK	
Black Alumalife® with flat, threaded Alumalife ring	Yes	Yes	Yes	Yes	Yes	4½", 6"
Black Cast Iron with flat, threaded ring of Alumalife on 4½" and 6" and Bronze on 8½", 10" and 12"	Yes	Yes	Yes	Yes	Yes	4½", 6" 8½", 10", 12"
Black Phenol Turret with snap ring	No	Yes	Yes	Yes	Yes	4½", 6", 8½"
Black Phenol with threaded phenol ring. Safety blowout disc is standard	Yes	Yes	No	Yes	Yes	4½", 6", 8½"
Black Alumalife with special ring held tightly at top by a hinge pin and at bottom by a clamp screw	No	No	Yes	No	Yes	4½", 6", 8½"
Black Cast Iron with special ring held tightly at top by a hinge pin and at bottom by a clamp screw	No	No	Yes	No	Yes	4½", 6", 8½" 10", 12"
Black Alumalife with black clamp slip ring	Yes	Yes	No	Yes	No	4½", 6"

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT
 MAKERS OF 'ASHCROFT' GAUGES, 'HANCOCK' VALVES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES,
 AMERICAN INDUSTRIAL INSTRUMENTS, BUILDERS OF "SHAW-BOX" CRANES, 'BUGGIT' AND
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$$N_s = \frac{n\sqrt{Q}}{H^{3/4}}$$

$$HP = \frac{H \times Q \times \text{sp. gr.}}{3960 \times \text{eff.}}$$

"WHAT'S YOUR PUMPING PROBLEM?"

PEERLESS HAS THE ANSWER

Many of the problems of transferring liquids which are troublesome to you today have probably already been successfully studied and solved for others by our engineering department.

Problems arising from countless combinations of conditions of capacity, head, temperature, pressure, specific gravity, viscosity, volatility, chemical analysis, solids concentration, NPSH and other variables have been resolved by our hydraulic engineers. From thousands of case histories we can counsel with you on everything from pump cavitation caused by misapplication to the design limits of impellers for various services.

Why not take advantage of 30 years of successful experience in the solution of thousands of practical pumping problems, to solve all YOUR pump applications?

Hand us your pumping problem. We probably can give you a successful Peerless answer to it from the scores of types and hundreds of models of horizontal and vertical Peerless pumps.

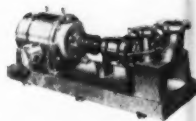
FOR PROCESS LIQUIDS AND WATER



TYPE CTB
CHEMICAL TRANSFER PUMP
Constructed with mechanical shaft seal and non-clog impeller. Request Bulletin B-1606.

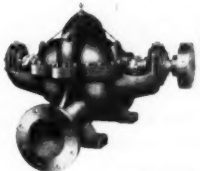


TYPE DS
CHEMICAL PROCESS PUMPS
An all-purpose chemical process pump for heavy duty service. Request Bulletin B-1600.



TYPE PR REFINERY
& PROCESS CHEMICAL PUMPS
Center-line-mount pump for elevated temperatures and pressures. Request Bulletin B-1605.

FOR WATER AND CLEAR ALKALINE LIQUIDS



TYPE A GENERAL PURPOSE PUMPS
Horizontal split case design for capacities to 70,000 gpm. Request Bulletin B-1300.

TYPE TU MULTI-STAGE PUMPS
2, 3, 4 & 5-stage pumps for high pressure service. Request Bulletin 310.



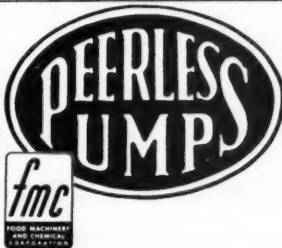
Remember - PEERLESS BUILDS DEPENDABLE PUMPS

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, Calif. and Indianapolis, Indiana
Offices: New York, Atlanta, Chicago, St. Louis, Phoenix, Fresno, Los Angeles, Dallas, Plainview and Lubbock, Texas; Tulsa, Albuquerque, New Mexico.

Distributors in Principal Cities; Consult your Telephone Directory



PEERLESS PUMP DIVISION

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301 West Avenue 26, Los Angeles 31, California

Please send us a Bulletin on:

☐ Type CTB Pump ☐ Type DS Pump
☐ Type PR Pump ☐ Type A Pump ☐ Type TU Pump

NAME _____

COMPANY _____

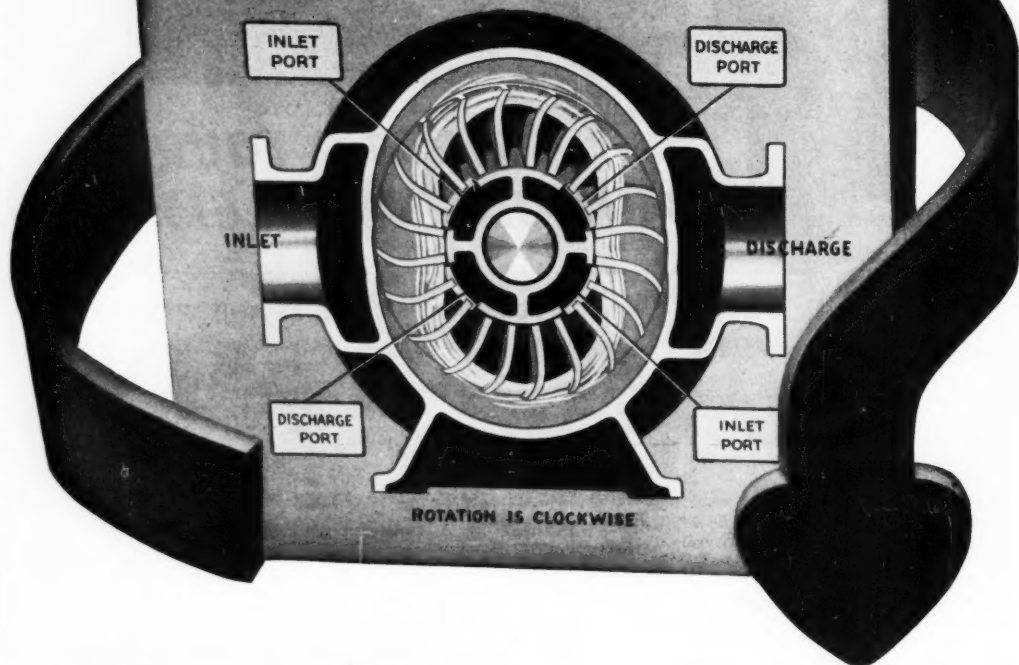
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Circle 12 on Reader Service Card

**Nash Instrument Air Compressors
deliver only clean air, free from
oil or dust, and without filters**



Here is Why!

You can dispense with oil filters and dust filters when you install ©Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

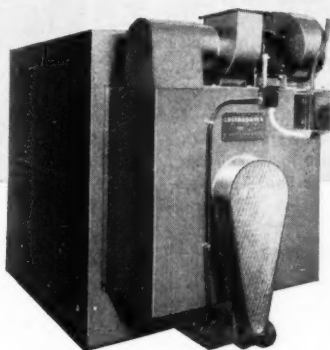
©Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

No oil filters.
No dust filters.
No internal lubrication to contaminate air handled.
No internal wearing parts.
No valves, pistons, or vanes.
Non-pulsating pressure.
Original performance constant over a long pump life.
Low maintenance cost.

NASH ENGINEERING COMPANY
397 WILSON, SO. NORWALK, CONN.

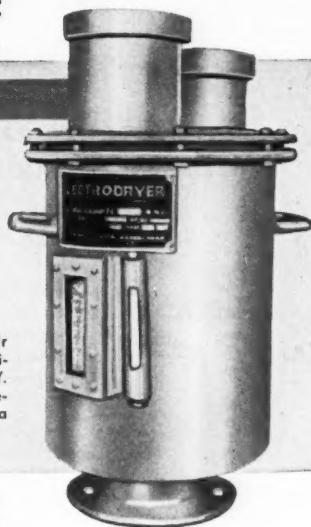
Put your storage tanks on a DRY air diet with Lectrobreathers*

*The moist air they're inhaling
wastes money and destroys quality*



A tank breathes freely, as air passes through the charge of Activated Alumina and is dried DRY. When a Lectrobreather needs reactivation, it is lifted off and a spare takes its place.

Where volumes of air passing in and out of a storage tank are sufficient, a Lectrodryer* is used. Since its DRYing-reactivating cycle can be reversed as required, it stays right on the job.



A processor was buying certain liquids in drums, at *premium prices*, because the moisture in the air the storage tanks inhaled injured their quality. Then he discovered Lectrobreathers, which feed only DRY air to the tanks. Now he buys in tank-car lots, saving on raw materials, saving on handling and holding quality constant.

An oil company safeguards its fine lubricating oils against contamination by water from the time it is refined until it is safely packaged. They hold a blanket of DRY air over the oil by forcing the tanks to breathe through Lectrodryers that

remove every trace of moisture from the air.

Lectrobreathers and Lectrodryers will make certain that any tank, little or big, breathes only DRY air. Which to use is determined by the size of the DRYing task: A Lectrobreather has a color indicator which tells when it should be reactivated. Operation of a Lectrodryer can be made fully automatic.

For help in selecting and applying the DRYing equipment you need, tell your problem to Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.

In Australia: Birlec, Limited, 51 Parramatta Road, Glenside, Sydney.

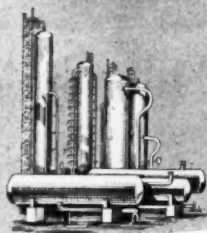
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.

In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Brussels-Liège.

**LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS**

LECTRODRYER

* REGISTERED TRADEMARK U.S. PAT. OFF.



DESIGNED FOR PRESSURE... PRODUCED FOR PERFORMANCE

PRECISION RUGGEDNESS OF MIDVALE PRESSURE VESSELS OFFER UNFAILING SERVICE...INCREASED PRODUCTION

Small vessels to withstand extra high pressures, or one of the largest forged steel high pressure vessels as shown below . . . Midvale makes them all.

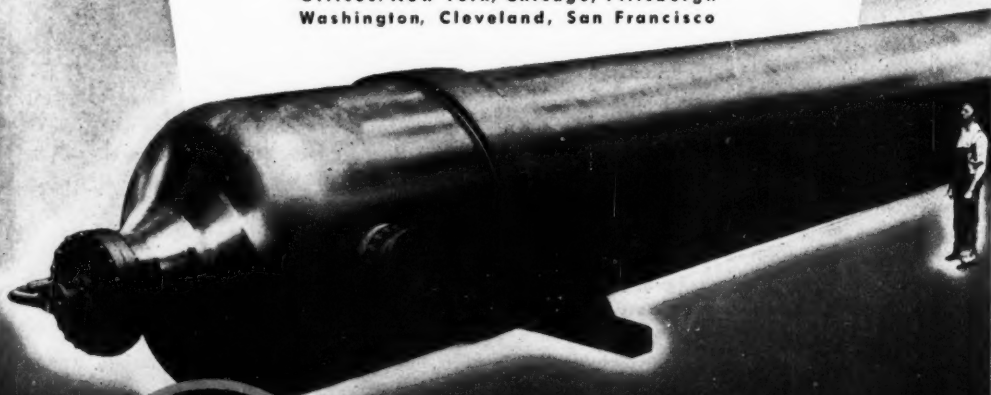
Precision control from the melting of the steel to the final machining is one of the secrets of the dependable service in every Midvale pressure vessel. Close cooperation of Midvale engineers in designing and building assures satisfactory operation of the finished vessel. That's why leaders in the chemical, refining and processing industries specify Midvale for pressure vessels.

Whatever your specifications you'll find Midvale's skilled craftsmen with their modern facilities and years of experience can build to your design or specification one piece hollow forged bodies of carbon, alloy or stainless steel.

THE MIDVALE COMPANY

NICETOWN • PHILADELPHIA 40, PENNA.

Offices: New York, Chicago, Pittsburgh
Washington, Cleveland, San Francisco



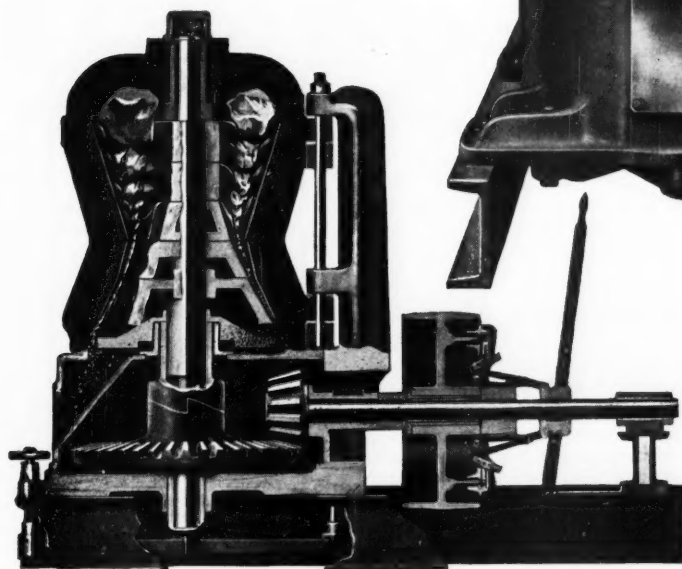
MIDVALE

Custom Steel Makers to Industry

PRODUCERS OF FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

STURTEVANT ROTARY FINE CRUSHERS

**Crush or
Granulate
to Fine, Even
Sizes without
Excess Dust...**



Cross section view illustrating the crushing action

These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine . . . crush fast and do not clog. Available in output capacities from 1 to 30 tons-per-hour. Write for catalog.

STURTEVANT MILL COMPANY

100-A CLAYTON STREET, BOSTON 22, MASSACHUSETTS

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

CLIP AND MAIL COUPON TODAY

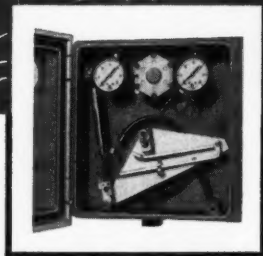
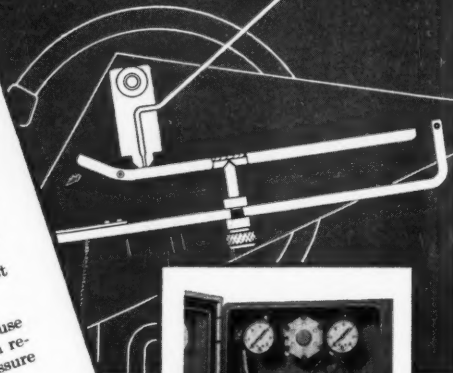
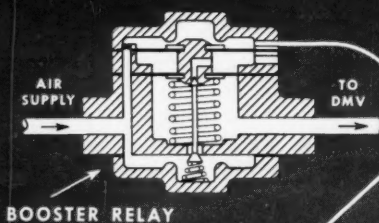
Sturtevant Mill Company
100-A Clayton Street
Boston 22, Massachusetts

Gentlemen:
Please send me catalog describing
your Rotary Fine Crushers. I am inter-
ested in crushing

Name _____
Street _____
City & State _____
Firm _____

It's the
BOOSTER RELAY
that gives this
Pressure Controller
these **4**
exclusive features

- 1** *It's accurate* . . . provides closest control performance, including full valve travel with proportional band set as low as 1 per cent.
- 2** *It's fast* . . . the booster relay's large independent air supply permits fast response of the valve, regardless of the size of the valve actuator.
- 3** *It's sensitive* . . . responds to the slightest pressure changes.
- 4** *It uses a minimum amount of air* . . . use of booster relay permits small nozzle which requires only 0.1 scfm under steady state pressure conditions.



Internal view at top shows arrangement of elements depicted in diagram. External view at bottom shows Pressure Pilot with door closed.

New Honeywell Pressure Pilot

In ruggedness, too, the Pressure Pilot leads the way. It goes anywhere . . . takes the toughest field conditions in stride. It makes a fitting companion, of course, for Honeywell's Series 700 valve line. It has every other feature you need: easy adjustment of set point, positive overload protection, simple construction, quick reversibility, universal mounting; and best of all, the cost is surprisingly low.

Our nearest engineering representative will be glad to demonstrate the Pressure Pilot for you right in your plant. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Industrial Division,
1904 Windrim Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
VALVE PRODUCTS

First in Controls



● Important Reference Data

Write for new Bulletin 16-1, "Honeywell Pressure Pilot."

A SANDVIK STEEL-BELT CONVEYOR

may belong in YOUR plan FOR BETTER PROCESSING

White lead being processed on a Sandvik conveyor.

Sandvik water-bed conveyor for processing fused glass.

Sandvik conveyors used in ovens for chemical processing.

Sandvik conveyors, designed for specific jobs, have opened the door to faster, better processing in plant after plant. Perhaps a Sandvik unit can do the same for you.

BASIC ADVANTAGES—Sandvik conveyors have a solid band of flat, stainless or carbon steel. The band provides a smooth, hard, impervious surface that is easy to keep clean. It has a high load capacity and a long service life. It can be fitted with simple discharge devices that scrape material off at any point. It can be used to convey materials through ovens. Belts can be of any length or width.

COOLING ARRANGEMENT—Sandvik conveyors can be built with a patented water-bed arrangement which cools from beneath . . . no water gets on top of the band. You can cool and convey, regulate thickness while cooling, cool and strip off gelatinous materials in sheet form, cool loose and pulverized materials, cool solids in sheet form and cool materials in layers.

ENGINEERING HELP—Sandvik's engineering department will be glad to help you determine where and how a Sandvik conveyor can improve your processing. Sandvik builds complete conveyors to fit the job.

Write, wire or phone for further information.

SANDVIK STEEL, INC.

Conveyor Department

111 EIGHTH AVENUE, NEW YORK 11, N. Y. • WAtkins 9-7180
Manufacturers of Steel Belt Conveyors for Over Thirty Years



POWELL Corrosion-Resisting VALVES

There are Powell Valves made of the right materials* to meet all requirements of the **CHEMICALS AND PROCESS INDUSTRIES**

*Powell Valves are available in the greatest variety of Corrosion-Resistant Metals and Alloys ever used in making industrial flow control equipment.

The Wm. Powell Co.
Cincinnati 22, Ohio

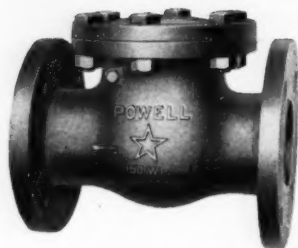


Fig. 2433 S. S.—Large size Stainless Steel flanged end Swing Check Valve for 150-pound W. P. Bolted cap with body-cap bolts and nuts in Stainless Steel. All dimensions conform to latest standards. Available in various other corrosion-resisting metals and alloys. Also made with screwed ends.



Fig. 1832—200-pound Stainless Steel Gate Valve. Screwed ends, screwed-in bonnet, inside screw rising stem. Available in many other corrosion-resisting metals and alloys.

Belt-O-Seal "V" Valve. Designed for high vacuum service and for handling hazardous, lethal, or malodorous fluids. Flexible metal bellows, enclosed in the body, completely seals interior of valve from outside atmosphere. Streamline design provides full flow area through valve. Made with flanged, screwed, or welding ends in various corrosion-resisting metals and alloys. Globe and Angle valves also available.

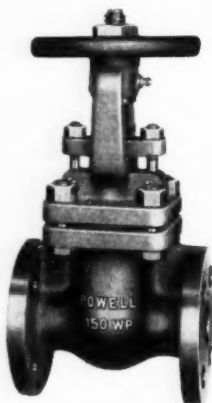


Fig. 2491—150-pound O. S. & Y. Gate Valve with precision-fitted, quickly interchangeable, solid or split wedge. Stem is threaded and guided through revolving bushing in upper yoke, which has a compression lubricant fitting. Available in a wide variety of corrosion-resisting metals and alloys. Also made with screwed ends.



Fig. 1842—200-pound Bronze Solder Joint Gate Valve with inside screw rising stem, union bonnet and tapered wedge; solid in sizes $\frac{1}{4}$ " to $\frac{3}{4}$ ", inclusive; double in sizes 1" to 3", inclusive.

POWELL VALVES for CORROSION-RESISTANCE are available in the following metals and alloys

Stainless Alloys	Nickel and Nickel Alloys	Bronzes—Acid, Aluminum, Silicon
18-8S	Nickel	Everdur
18-8S Mo.	Monel Metal*	Herculoy
18-8S Co.	Inconel*	Ampco
Misco "C"	Hastelloy Alloys†	Ampcoloy
Durimet 20	(A, B, C and D)	76
11 S-13 5% Cr. Iron	Illium	90-10
18% Cr. Iron	D-10	88-10-2
28% Cr. Iron		
25% Cr. 12% Ni		
	Cast Irons	Aluminum
Alloy Steels	Cast Iron	Alcoa No. 43
Carbon Steel	3% Nickel Iron	Alcoa No. B-214
4-6% Cr. 5% Mo	Ni-resist*	Alcoa No. 61 S-T
3 5% Nickel Steel		
6-8% Cr. 5-75% Mo	Hard Lead	Molybdenum
8-10% Cr. 11-1 5% Mo		
	Silver	

*Registered trade names of the International Nickel Co., Inc.

†A registered trade-name of the Haynes-Stellite Co.

POWELL VALVES

In Bronze, Iron, Steel and Corrosion-Resisting Metals and Alloys.

Sulphur



Molten Sulphur Flowing into the storage vat

*Thousands of tons mined daily,
but where does it all go?*



Look around you in any grocery store and what do you see — canned goods of all kinds! Soups, vegetables, fruits, berries! Believe it or not, you're looking at merchandise that consumed a lot of Sulphur in the making.

Tin cans are made of tin plate. Tin plate is made of sheet steel. Sheet steel is made with the help of sulphuric acid—pickling, as they call it, the process that removes scale preparatory to plating. In 1951, the sheet division of our great iron and steel industry is estimated to have consumed 140,000-long tons of Sulphur in the form of sulphuric acid. That in itself makes quite a dent in our supplies of Sulphur. Add to this almost as much more for treating wire rod, plate, strip, bars, etc., and you can see that to make finished steel, regardless of form, the iron and steel industry must use lots of Sulphur in the form of sulphuric acid.

Right here is an excellent example of the interdependence of all of our industries. To produce steel requires a lot of Sulphur. To produce Sulphur and other mined products requires a lot of steel. This interdependence of industries is one of the country's sources of strength.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas



Benzol Products Co. solves tough vacuum problem with Worthington Steam Jet Ejectors

*18 units installed since 1942
for operation under extremely
corrosive conditions*

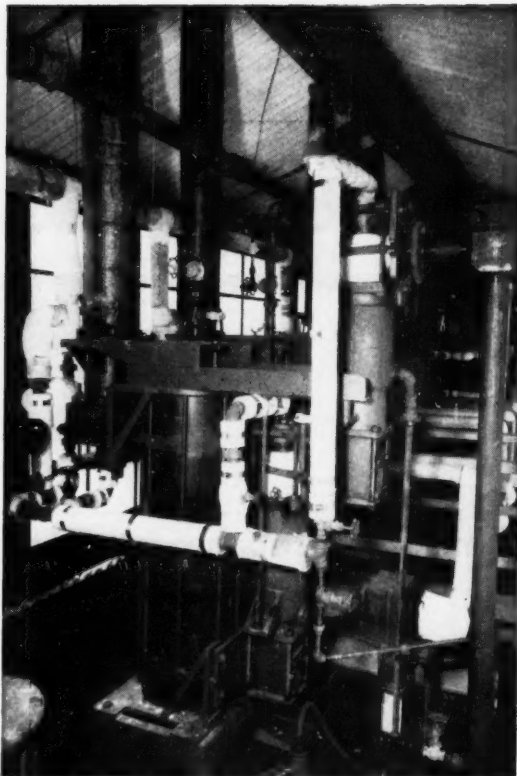
Benzol Products Company of Piscataway, New Jersey, had a real problem on their hands.

Until 1942, they were having extreme difficulty with maintenance and operation of their vacuum pumps due to the highly corrosive vapors resulting from their processes. In 1942, they replaced a vacuum pump with a Worthington corrosive resistant ejector, and it was so successful that they have now replaced all of the vacuum pumps for corrosive service with ejectors. Some of the units installed in 1942 and 1943 are still equipped with their original nozzles and diffusers—in spite of 24 hour-a-day, 6-day-a-week operation.

Corrosion—the one big problem—has been eliminated by the material from which these particular ejectors are made—impervious graphite.

Worthington's experience with ejectors dates back to 1918. And today, there's a Worthington model for every vacuum requirement—from atmosphere to 50 microns absolute, single and multiple stages, condensing and non-condensing, of stainless, bronze, porcelain, impervious graphite, Worthite, cast iron and steel.

Write and tell us about your specific requirements. Worthington Corporation, Steam Power Division, Ejector Section, Harrison, New Jersey.

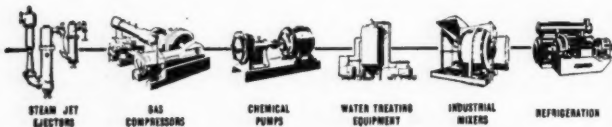


WORTHINGTON STEAM JET EJECTOR MADE OF IMPERVIOUS GRAPHITE for corrosion resistance. Installation at Benzol Products Company plant in Piscataway, New Jersey, used on vacuum service in production of synthetic allethrin. This three-stage unit operates at 2 mm Hg absolute.

6 Big Advantages of Steam Jet Ejectors for Vacuum Service.

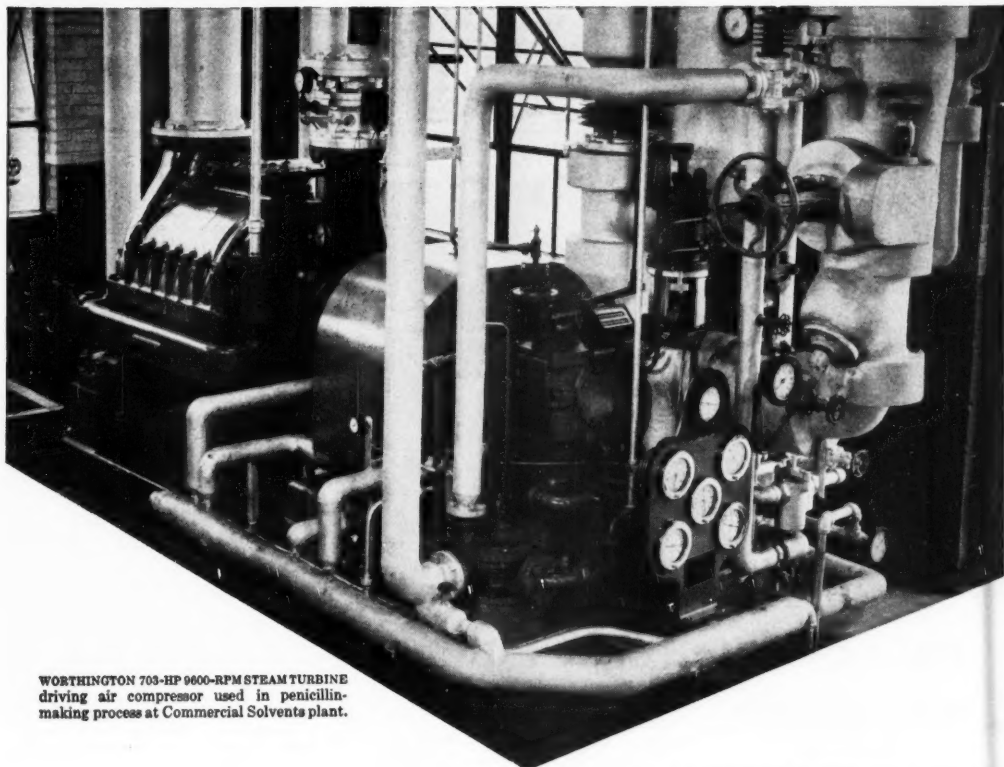
1. Initial cost is low.
2. Operating costs are at a minimum.
3. Maintenance costs are negligible.
4. There are no moving parts.
5. Easy to operate.
6. They can be manufactured of any machinable material.

X.2.1



WORTHINGTON

Steam Jet Ejectors



WORTHINGTON 703-HP 9600-RPM STEAM TURBINE driving air compressor used in penicillin-making process at Commercial Solvents plant.

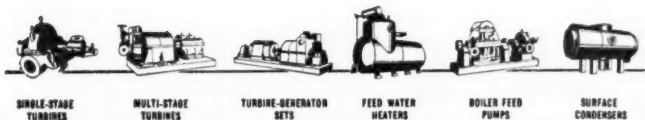
9600-rpm turbine drives compressor in making penicillin for Commercial Solvents Corp.

Two years ago, a Worthington high-speed steam turbine was installed in the Terre Haute, Indiana, penicillin plant of Commercial Solvents Corporation. Its high efficiency and economical steam consumption plus its low maintenance demands have justified that selection many times over.

In addition, use of Worthington high-speed, direct-drive turbines to drive centrifugal compressors or blowers makes possible a broad speed range, elimination of costly speed increasing gears, and adaptability to various governing arrangements for precise control under all operating conditions. Worthington's design flexibility provides you with the *right* type and size turbine for optimum performance—regardless of your requirements.

Remember, when you're considering turbines for driving compressors, the engineering of the turbine is just as important as the engineering of the compressor. Worthington's long and complete experience in compressor-drive engineering is your assurance of maximum efficiency. Write for Bulletin 1966 to Worthington Corporation, Steam Turbine Division, Wellsville, N. Y.

T-2-19



SINGLE-STAGE
TURBINES

MULTI-STAGE
TURBINES

TURBINE-GENERATOR
SETS

FEED WATER
HEATERS

BOILER FEED
PUMPS

SURFACE
CONDENSERS

A GREAT TEAM IN STEAM

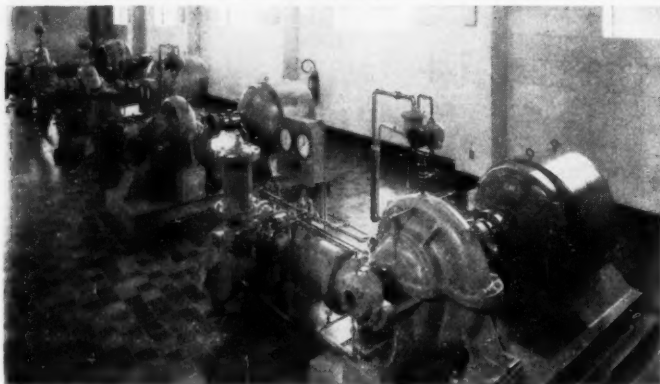
WORTHINGTON



Steam Turbines

POINTERS ON PUMPS

Prepared for Industry by Worthington Pump and Machinery Corporation



A Plan That Gets the Most out of Centrifugal Pumps

**Easy-To-Install Maintenance
Program Means Better Performance,
Longer Life**

You can't get maximum production when your equipment's operation is constantly interrupted due to breakdowns. Moreover, today's equipment shortages make it increasingly more important that you get all the life you can out of your present machines.

We'd like to suggest a maintenance plan that will help you get the most out of one of your most vital pieces of equipment—centrifugal pumps.

Keep Informative Records

If you haven't already done so, it's a good idea to begin your maintenance plan by setting up a card index file so that you can catalogue each pump in your plant. Each card should contain the following information: plant pump number, size, manufacturer's name and style, serial number, date installed, and any other data which will help you to rapidly locate repair parts lists and manufacturer's parts numbers.

The rest of the card can be divided into a number of columns: Repair Date, Part Affected, Remarks, and Cost. A typical card is shown here.

[illegible]

If you're careful to enter every maintenance or repair operation on the proper card, it won't be long before each card indicates a particular pattern of maintenance.

Set Up A Maintenance Schedule

Once this pattern is established for all the cards, you can set up a schedule of maintenance points for such items as: packing, greasing or oiling, painting, gasket replacement, and bearing exami-

nation. You may find, for example, that a unit or group requires packing maintenance about once every three months, and greasing once every four to six months, etc.

Your next step is to arrange a plant schedule so that a particular pump may be shut down for maintenance at or before these times. Thus you make it possible to do the maintenance work under proper and unhurried conditions to assure maximum conformity of production consistent with long pump life. In addition, examination of the card catalogue will guide operating and maintenance personnel as to quantity of repair parts they should keep on hand.

Make Periodic Inspections Externally

It is considered *inadvisable* to open pumps for inspection.

Rather, recent practice is to let pumps stay on the line until such time as external symptoms indicate overhaul may be required. These symptoms involve either a reduction in effective capacity because of wear at the internal clearance points or mechanical difficulties, such as vibration or noisy operation.

Parts requiring most frequent replacement in centrifugal pumps are: wearing rings, shaft sleeves, packing and bearings.

The most important maintenance point on process pumping equipment is the stuffing box. It must be kept clean, cool, and lubricated—but *packing* is the crucial operation. A good packing method will be discussed in a later edition of *Pointers on Pumps*.

Don't forget the frames, base plates, and supporting parts of your pumps. Good housekeeping often makes it easier to do a good overall maintenance job!

Can We Help You?

Worthington makes more *standard* pumps than any other manufacturer. Don't buy a "special" (at a higher price) without checking to see if Worthington makes it *standard*.

If you do need a special, remember Worthington's modern engineering facilities, backed by the longest and broadest experience in the field. Contact our nearest District Office or write to Worthington Corporation, Centrifugal Pump Division, Harrison, N. J.



MENTAL FOCUS



RESTART



STEAM



POWER 9

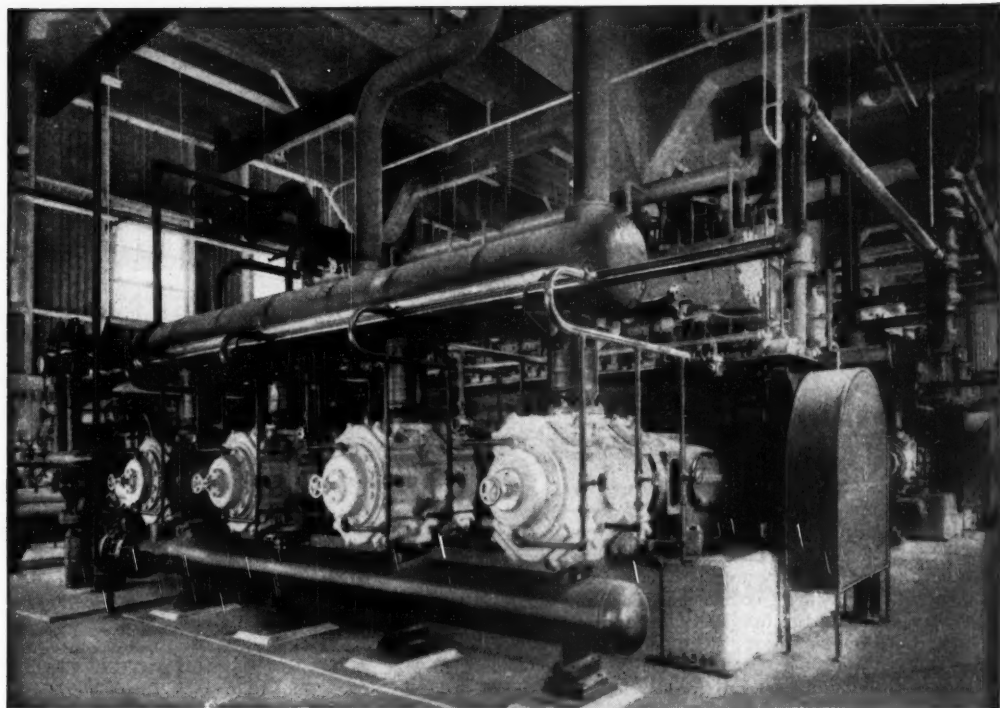


VERTICAL
TURNING

The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON

Centrifugal Pumps



WORTHINGTON ANGLE GAS-ENGINE COMPRESSOR installation in a gas pipeline pumping station.

Now . . . more horsepower, higher efficiency in Worthington Angle Gas-Engine Compressors

New LTC-H compressor has all advantages of famous LTC plus high compression

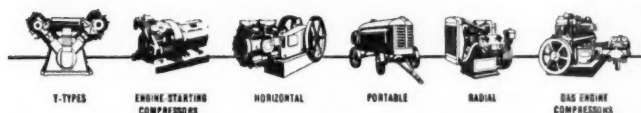
This new Worthington LTC-H Angle Gas-Engine Compressor—the latest Worthington advance in its engine-compressor design—is typical of the kind of improvement achieved by Worthington engineers throughout many years of leadership in the manufacture and application of compressors and large internal combustion engines.

The new high-compression engine-compressor has considerably higher horsepower ratings than its well-known predecessor, the LTC, but runs cooler and on less fuel. LTC-H users will find the new unit is built

to give the same day-in, day-out service that has given all Worthington Engine-Compressors a reputation for extreme dependability throughout the gas, petroleum and chemical worlds in *pipeline pumping, refinery operations, public utility gas distribution, and service in natural gasoline and pressure maintenance plants, petro-chemical and synthesis plants, and refrigeration plants.*

Write for more information on this latest development in Bulletin L-690-B1B or let us know that you're interested in conversion of your present unit. Worthington Corporation, Compressor Division, Buffalo, N. Y.

K.2.16



NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



**for the vital job
of cooling lube oil on
these pumps and blowers**

Roots-Connersville selected Ross Exchangers

The ability of Roots-Connersville blowers, exhausters and pumps to maintain peak performance even under the most challenging conditions, stems from 98 years of experience in sound engineering and fine craftsmanship.

This record naturally precludes any gamble with the quality of outside-built components. Logically then, the exchanger selected to fully safeguard lube oil temperature must be of known quality and proven efficiency.

Thus, to protect its reputation and match its claims of long-time durability and freedom from breakdown, Roots-Connersville has become a large user of Ross Type BCF Exchangers in both its centrifugal and rotary positive type machines, especially on larger units like those shown.

Ross Type BCF Exchangers are contributing to the peak performance of hundreds of thousands of machines produced by other leading manufacturers. Pre-engineering, full standardization and mass production have made these compact, all-copper and copper alloy units vastly preferred throughout industry.

Insist on Ross Exchangers for the machines you build, buy or now operate. Write for Bulletin 1.1K5.

KEWANEE-ROSS CORPORATION

DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1411 WEST AVENUE BUFFALO 13, N. Y.
In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

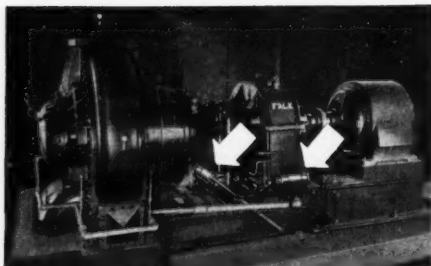


EXCHANGERS

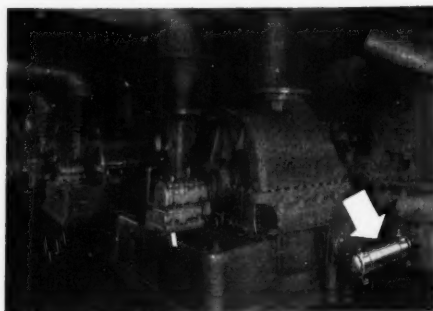


Serving home and industry

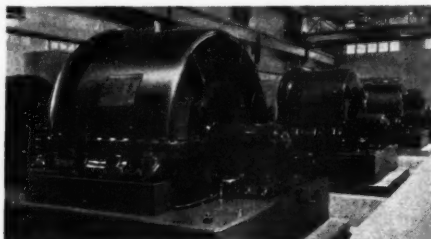
AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • POSS HEATER • TONAWANDA IRON



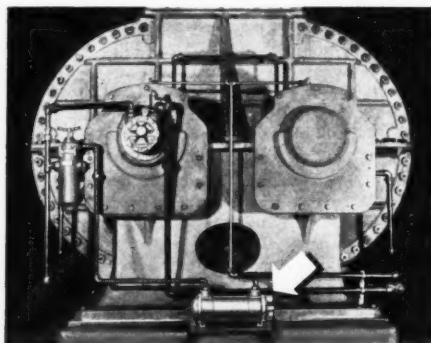
Roots-Connersville high pressure rotary gas booster motor driven through a speed reducer, both equipped with Ross Type BCF Exchangers.



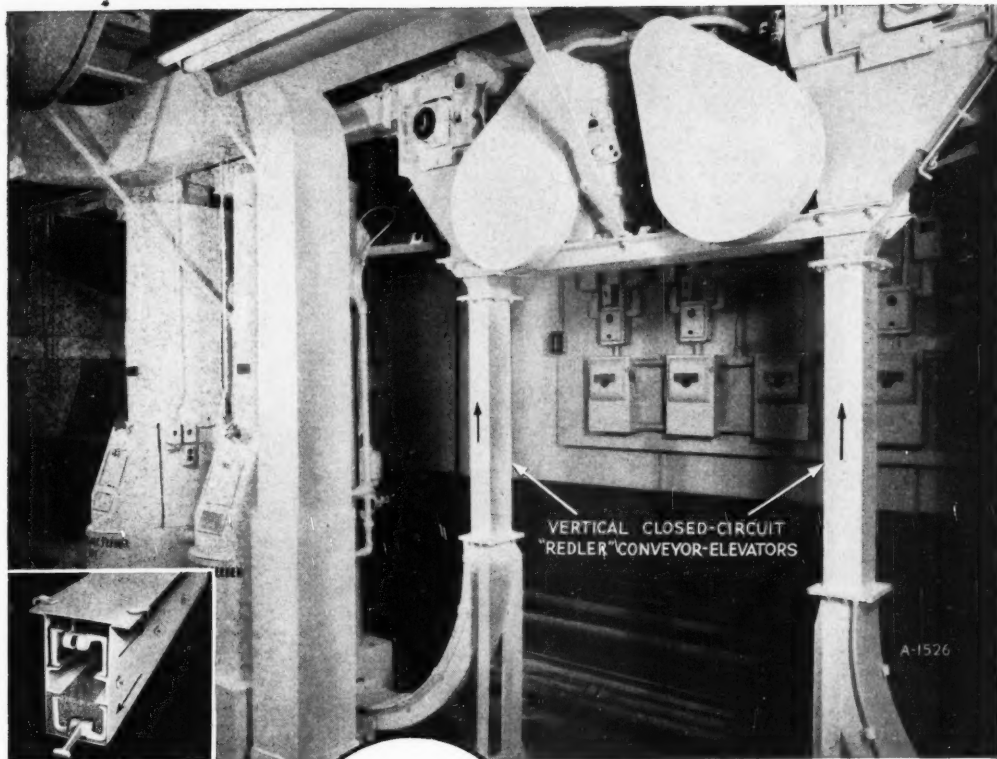
Battery of Roots-Connersville turbine driven multi-stage centrifugal blowers handling coke oven gas, all equipped with Ross Type BCF Exchangers.



Four Roots-Connersville multi-stage centrifugal air blowers, each equipped with a Ross Type BCF Exchanger.



Roots-Connersville rotary positive steam turbine driven gas booster equipped with Ross Type BCF Exchanger.



A sanitary, dust-tight system of five REDLER vertical-closed-circuit, conveyor-elevators is used to handle alum, lime, etc., from hopper boxes to storage and then to feeder units which send materials to water processing operations. Totally enclosed REDLER casings eliminate dust, prevent contamination and spillage and permit a neat, dust-free installation in a minimum of space.

S-A CONVEYING Systems

for **SANITARY, DUST-TIGHT**
movement of bulk chemicals at low cost

In this modern filtration plant, an S-A System of five REDLER conveyor-elevators is employed to handle up to 20,000 pounds of chemicals per hour! . . . In minimum space! . . . At lowest cost per ton! Installations such as this are not unusual to S-A engineers—they have the experience and the equipment to solve even the most complex bulk materials handling problems efficiently and economically. A line or two on your letterhead will bring particulars promptly.

REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Vibrating Conveyors
Belt Conveyors
Screw Conveyors
Bucket Elevators
Pan Conveyors and Feeders
Circular Bin Dischargers
Centrifugal Loaders and Pilers
TELLEVEL Bin Level Controls
Ship Loaders and Unloaders
Storage and Reclaiming Systems
Box Car Loaders and Unloaders
Bin Gates, All Types
SEALMASTER Ball Bearing Units
Write for Bulletins
on any of the above

STEPHEN **S-ADAMSON**

3 Ridgeway Avenue, Aurora, Illinois

MFG. CO.

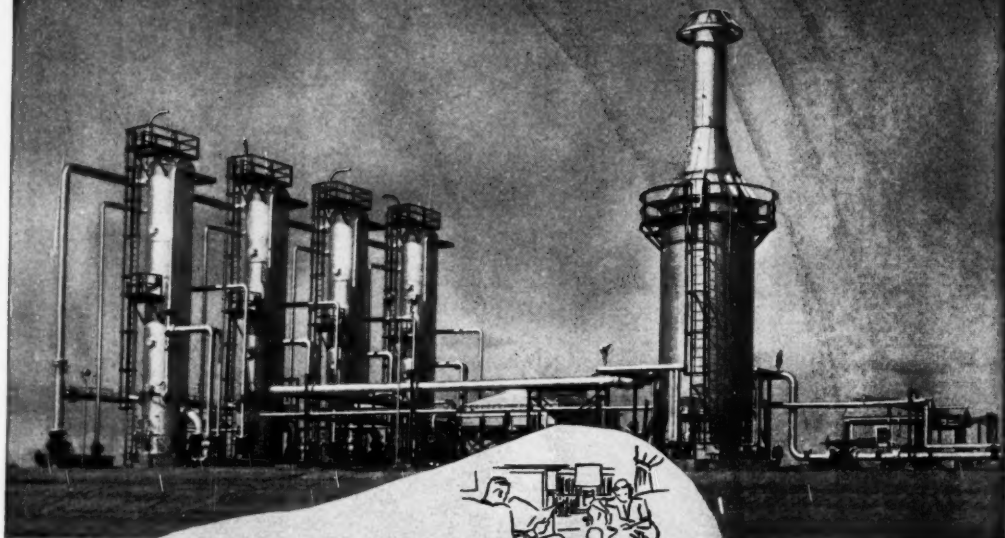
Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

CHEMICAL ENGINEERING—October 1952

477

BUILDING A GREATER AMERICA



Built at Sun Ship, on the Delaware, these dehydrating towers now serve Western homes and industries.

Across the wide Missouri



Pioneers in prairie schooners blazed a courageous trail "across the wide Missouri..." and across the entire continent... in their search for new opportunity.

The industrial services of modern America have followed in that trail. Thriving farms, towns and cities mark sites where pioneers found only hardship... because American industry is truly "All-American."

Today, *all* America shares the benefits of *all* of America's progress... because great companies develop and distribute the advantages latent in our natural resources... and because great industries like Sun Ship can build and deliver, anywhere in the world, the gigantic equipment needed to convert petroleum and various chemicals into light, heat, power and the other productive forces which serve mankind's comfort and progress.

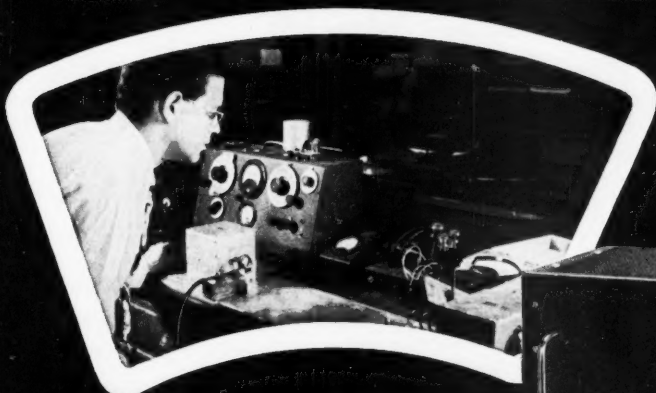
Sun

SHIPBUILDING & DRY DOCK COMPANY

(SINCE 1916)

ON THE DELAWARE • CHESTER, PA.
25 BROADWAY • NEW YORK CITY

ARE YOUR READINGS TRUE?



CABINET TYPE 1ES101



MODERN INSTRUMENTATION

Demands

STABILINE

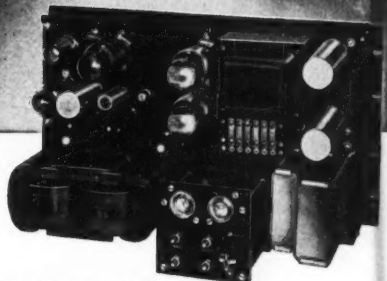
Automatic Voltage Regulators

TYPE

IE

INSTANTANEOUS
ELECTRONIC

RACK TYPE
1ES101R



You may have the best instrumentation in the laboratory — in shop processes — on test and inspection lines . . . you may collect the most concise data . . . but the information gathered is worthless unless it is dependably accurate. The best instruments can give true readings **only** when the source of voltage is constant.

There is no better way to maintain constant output voltage from a-c power lines than with a STABILINE Automatic Voltage Regulator type IE. This completely electronic device with no moving parts offers instantaneous correction of line voltage variation — waveform distortion not exceeding 3% — excellent stabilization and regulation. Numerous types are available in a wide range of ratings to fulfill the needs of your particular requirement.

Send today for complete information on STABILINE Automatic Voltage Regulator type IE, and at the same time, ask about STABILINE type EM. **Write to:**

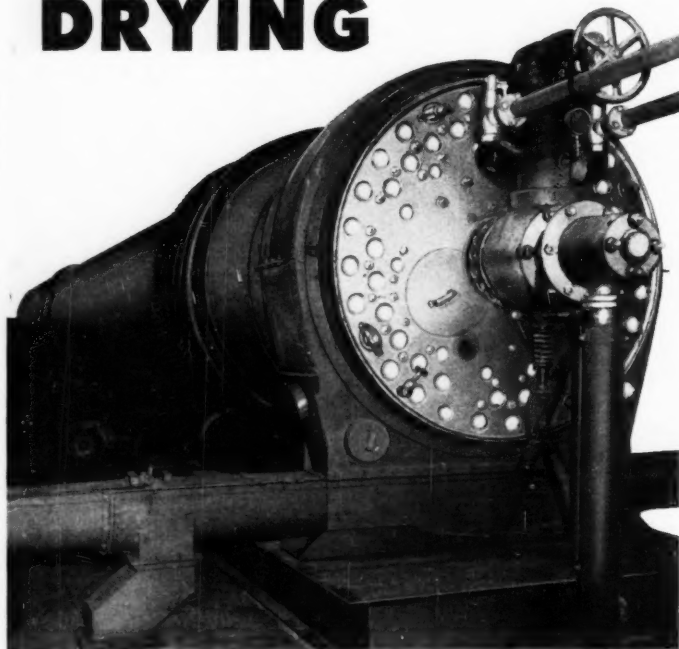
1410 THURE AVE., BRISTOL, CONN. and ASK FOR SECO BULLETIN S351.



- STABILINE AUTOMATIC VOLTAGE REGULATORS
- POWERSTAT VARIABLE TRANSFORMERS
- VARICELL D-C POWER SUPPLIES
- VOLTBOX A-C POWER SUPPLIES
- SUPERIOR 5-WAY BINDING POSTS
- POWERSTAT LIGHT DIMMING EQUIPMENT

HOW THE HURON MILLING COMPANY obtains
"Cleanliness and Economy" through

STANDARD D-IZED DRYING



STANDARD-IZED drying pays! Read the case history at the right for another convincing proof of this fact. Why not let STANDARD-HERSEY "engineered for economy" drying methods go to work for you, too? Standard Steel Corporation possesses the experience, size, and facilities to handle any drying problem, anywhere in the world. STANDARD-HERSEY "Pilot" dryers are available at all times to pre-test products for customers and prospective customers. Write TODAY for complete 12 page Dryer Bulletin No. 524, describing the more than 30 types of STANDARD-HERSEY dryers.



STANDARD STEEL CORPORATION

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One STANDARD-HERSEY dryer does work of 16 pairs of hot rolls, drying Monosodium Glutamate . . .

Excerpts from correspondence indicate effectiveness of STANDARD equipment in solving drying problems for Huron Milling Co., Harbor Beach, Michigan.

April 16, 1951

"... a few years ago we were drying Wheat Gluten, the raw material from which we make our Sodium Glutamate, on rotating hot rolls at the rate of 97.8 pounds of product per hour, per pair of rolls. 16 pair of such rolls were replaced by one of your 6' x 60' steam tube rotary dryers. The single rotary dryer handled the product formerly dried on the 16 sets of rolls, although its capacity was somewhat taxed in the process."

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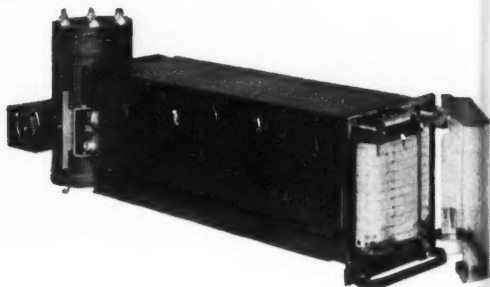
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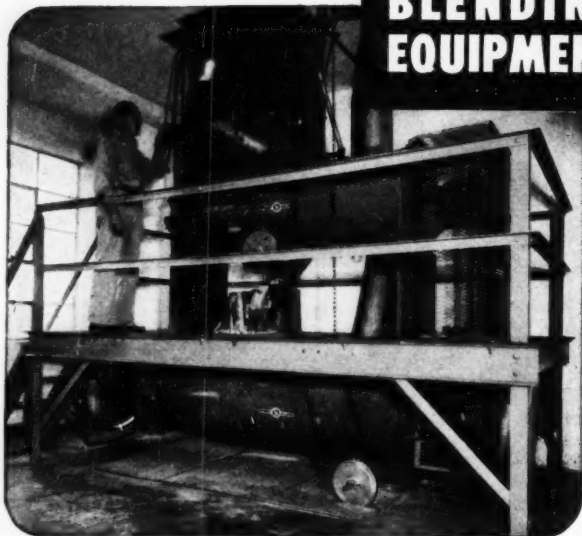
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The Reader



His Mark

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To the advertiser who contemplates using the magazine as an advertising medium, this symbol has a well-recognized significance. It tells him that the circulation records and practices of the magazine are wide open to the auditors of the Bureau, who check the publisher's claims and make public the precise terms and conditions under which subscriptions are obtained. And it assures him that the magazine stays in business by virtue of a demonstrated demand from its readers as shown by their paid subscriptions or newsstand purchases.

BUT HERE we are concerned only with the significance of ABC to you as a reader. For when the advertisers, the advertising agencies, and the publishers founded the Bureau nearly forty years ago to help establish honest circulation figures, they unwittingly set up a cooperative institution that has become a major safeguard for the interests of the reading public.

That is because membership in ABC constitutes one of the strongest guarantees that any publication can offer of its primary devotion to the interests of its readers. And by making that guarantee possible, ABC becomes a major safeguard of the freedom of the press, an objective of exceptional importance in these days when the public is flooded with propaganda from so many sources.

THE SUREST MEANS by which to preserve a free press is to keep it directly answerable to the reading public it would serve. It follows, then, that the survival of a truly free press must depend on its acceptance by that public; and that means in turn that the people must have in their hands some adequate means for holding the publishers responsible to them.

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TO SUPERVISE this vital process, to check and certify the integrity of the publication's circulation methods and claims, requires a strict and continuing audit of each publication's success in meeting this test of its public acceptance. To that essential function the ABC has contributed mightily by the conscientious performance of its mission. And that is why we are able to have a press supported, for the most part, by advertising revenues, but not controlled as to its circulation or content by any influence other than its readers.

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SO THE Audit Bureau of Circulations, by auditing and certifying paid circulations, has come to perform a vital service to the readers of this magazine and of every other member publication. And in performing that service, it helps to maintain in our country a press that is answerable to the reading public and to it alone. So long as the practices and principles for which ABC stands continue to prevail in American publishing, we shall find in it a sure support for a truly free press, responsible only to the public it serves.

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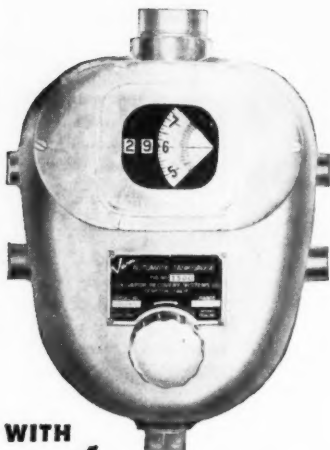
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YOUR BEST CHOICE IS "CONSOLIDATED"**FILTERING EQUIPMENT**

- 2—212 Sweetland Filters for 36 leaves on 4" c.c.
- 10—Shriver 42"x42", Iron Filter Presses, Plate & Frame, 18, 27, 36, 54 chambers, 1" cake.
- 16—Sperry 18"x18", Iron, P & F, Filter Presses, closed delivery, 11 chambers.
- 1—American Disc Filter 6' dia., 2 disc, 100 sq. ft. filtering area, with auxiliaries.
- 1—Shriver, iron, steam heated, 30"x30", 20 chambers, 1" cake.
- 1—8"x12" Oliver Lead-Wood Vacuum Filter Acid-Resisting.
- 3—Oliver Vacuum Filters, incl. 8x12", 11'6"x14", 11'6"x18".
- 1—ALUMINUM Sperry FILTER PRESS, 30 x30", 45 chambers, 1" cake.
- 1—Sperry, 24"x24" P & F Filter Press with 25 chambers, 2" frames.
- 1—27 Sweetland Filter with 20 steel leaves, 4" c.c., NEW 1951.

DOUBLE DRUM DRYERS

- 1—42" x 120" Buflovak Atmospheric S/S Conveyors, S/S Elevator, S/S Hood.
- 4—5' x 12' Buflovak Atmospheric.
- 2—32" x 90" Buflovak Atmospheric.
- 1—32" x 72" Buflovak Atmospheric.

EVAPORATORS

- 1—Quadruple Effect Evaporator, calandria type, brass tubes, 14,000 sq.ft. H.S.; excellent condition; still erected; complete with piping, etc.
- 4—Mojonnier S/S Vac. Pans, 3', 4', 5', 6'.

VIBRATING SCREENS

- 1—Tyler Hummer 4'x10', 2 deck, with 2 vibrators.
- 1—Battery of two 3'x5' Tyler Hummer, Type 33, with Generator Set for both.
- 1—3'x8' Selectro, single deck.
- 1—3'x8' Selectro, double deck—rebuilt.
- 1—18"x5' Selectro—rebuilt.
- 1—Day S/S single deck, 40"x84".
- 1—Tyler "Rotap" Testing Screen AC motor.

ROTARY KILNS & DYERS

- 3—Vulcan Iron Works 6'x60, complete, each with 3'x50' Rotary Cooler.
- 1—7'x45' Link Belt Kiln, complete.
- 1—7'6"x125'; 1—8'x135' Allis Chalmers Rotary Kilns.

- 4—Ruggles-Coles Direct Heat Rotary Dryers—Class XF4—54"x25", 2 Class XF 5'x40". Also L-B 27"x10' Roto Louvre; three 3'x50'; 5'x30'; 5'x50'; 6'x40'; 6'x60'; 7'x70'.

- 3—6'x50' Louisville Rotary Steam Tube.
- 1—4'x8' Flaker or Cooling Roll.
- 1—5'x33' Rotary Vacuum Dryer, jacketed shell; 1—20'x8', jacketed, with dust collector and condenser.

PEBBLE MILLS

- All porcelain lined
- 4—5' x 4', 235 gal.
- 3—6' x 8', 800 gal., porcelain and burstone lined.
- 1—Abbie 24 porcelain lined, 125 gal., 45" x 42".
- 1—Patterson 24 x 36", 25 gal.

PULVERIZERS

- 3—5047 Raymond High Side, 4 rolls, one with "whizzer" air classifier and oil journals; mill equipped with Raymond exhausters, cyclones and piping.
- 2—50 HP 3/60/2200 volt motors with ea. of two mills.
- 1—4'x7' Ball Mill, Allis Chalmers, iron lined. Used 100 hours.
- 3—Mikro Pulverizers, 2SL, 4TH.
- 1—6'x15" Sturt. Jaw Crusher, to 1 1/2".
- 1—24"x15" Sturtevant Crushing Rolls, balanced type.

JACKETED KETTLES

- 2—500 gal. steel jacketed closed agitated Vacuum Reactors.
- 6—Dopp C.I. 80, 100, 150, 350, 600 gal.
- 7—Steel, agitated, 350, 500, 700, 800.
- 1—300 gal. stainless steel, 100±.
- 2—700 gal. closed, with Simplex Turbo Mixers, reduction drive, m.d.
- 3—3500 gal., welded, agitated, open.
- 28—Aluminum and Copper, 30 gal. to 600 gal., some agitated.

NEW STAINLESS STEEL FABRICATION

We have available excellent facilities for fabricating Stainless Steel Tanks, Kettles, Condensers, Reactors, Autoclaves, Distillation Columns, Filter Presses, Heat Exchangers, etc. ASME Code Construction. Will gladly furnish estimates to your specifications.

SPECIALLY PRICED FOR QUICK REMOVAL

- 6—Devine 28 Vacuum Shelf Dryers, each 20 shelves 59" x 78", surface condensers and vacuum pumps.
- 2—Ball & Jewell 22 Rotary Cutters.
- 1—Tolhurst 48" steel basket Centrifugal, suspended type, bottom discharge.
- 4—Traylor Tube Mills, 5' x 22", 5' x 20", 4'6" x 18'6", 4' x 13", each stone-lined, scoop feed, pebble charge, clutch pulley. Still installed in one plant as operated, with all accessories as used.

DRY POWDER MIXERS

- 1—Kilby jacketed Horiz. Ribbon Mixer, 450 cu. ft. capacity.
- 1—Howes 3,000±, double ribbon.
- 1—Day Size F, 1850±; 1—Howes 1,800± dbl. ribbon; 1—Manson Rotary 1,000± batch; 1—Day 400±.

MISCELLANEOUS

- 1—42" Stainless Steel A.T.&M. Co. Centrifugal, 40 H.P. Motor.
- 1—Tolhurst 40" monel Centrifugal.
- 1—13,500 gal. Stainless Steel Tank, closed, agitated, S/S coils, m.d.
- 5—Labour S/S pumps, 5 & 10 H.P.
- 2—Buflovak 6' dia. Vacuum Crystallizers; 1—6' dia. Atmospheric, jacketed.
- 1—6'x14' Hardinge Rotary Counter Current Classifier, also for dewatering or scrubbing.
- 2—Dorr two-stage Classifiers, each with two rakes, total length 27', gear reducer and motor.
- 1—Davenport 23A Dewaterer, with speed reducer and 5 HP AC motor.
- 1—Mechanical Cooker, 5' dia. x 18 long, jacketed, agitated, Insur. Certificate.
- 1—Copper Rectifying Column, 6 sections, 30" dia. x 33' high, bubble cap type.

BAKER PERKINS MIXERS

- 4—3000 gallon, size 30, type X-B5, welded.

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3 HP, 14.56 RPM Patterson.
10 HP, 56 RPM, Patterson, XP.
1 HP, 1150 RPM, Lightnin, XP.
1/2 HP, 1150 RPM, Lightnin, XP.

CENTRIFUGALS

40" perforated, steel, Tolhurst.
40" perforated, SS, Fletcher.
40"x60" Bird, rubber covered.
36"x50" Bird, rubber covered.
24" Bird, CH, SS, series 200.
18"x28" Bird, SS.

ROTARY DRYERS—KILNS

10"x90"x9/16" Allis-Chalmers.
8"x80"x3/4" Vulcan.
7"x125"x1/2".
7"x60"x3/4" with lifters.
7"x45"x1/2".
6"x27" Louisville, 4 1/2" SS tubes.
6"x14"x9/16" Struthers-Wells (NEW).
5"x67"x5/16" with lifters.
46"x50" Vulcan.
46"x40"x3/4".
4"x35"x1/2" with burner.

DRYERS—MISC.

3"x15" Rotary, Vacuum, Jack't'd., SS clad.
32"x72" Double Drum.
30"x8" Stokes, Rotary, Vacuum, complete.
5"x6" Blaw-Knox, Atmos., single drum.
24"x28"9" Proctor & Schwartz Conveyor.
8"x94" Proctor & Schwartz SS Conveyor.
6"x40" Proctor & Schwartz Conveyor.

FILTERS

#7 Sweetland, 2" spacing, 28 leaves.
36", 35 chambers, center feed, open.
30" Shriver, skeleton.
12" Sperry, aluminum chambers.
11'6" x 18' Oliver, all steel.
8'x12' Feinc, all steel.
8'x10' Oliver, wood and steel (3).
8'x8' Oliver, lead covered.
4'x5'3" Oliver, all steel.
3'x4' Oliver, steel.

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2000 gal. agit. jack't'd., 200 PSI (3).
1000 gal. 54"x7"x3/4", 300 PSI.
500 gal. Pfaudler, type LL.
400 gal. Pfaudler, jack't'd., agit.
40 gal., SS, jacket 40 PSI.

TANKS & PRESSURE VESSELS

135,000 gal. 30"x26" with coils.
16,000 gal. 96"x45"x3/4" 150 PSI, ASME.
12,000 gal. 8"x32"x1/4" (NEW).
8,500 gal. vert. 8"x23"x5/16" (NEW).
8,200 gal. 70"x40"x2" 390 PSI (4).
6,000 gal. 8"x15"x3/4" ALUMINUM.
4,100 gal. vert. 5"x28"x1/4" (NEW).
3,400 gal. 74"x10"x3/4", type 430 SS.
1,250 gal. 4"x14", 106 PSI.
1,050 gal. 4"x12"x1/2", 106 PSI.
6,500 gal. TANK CAR TANKS.

TANKS—LEAD LINED

1200 gal. 5"x8"x1/4".
900 gal. 5"x6"x5/16" agitated.
525 gal. 42"x7"x1/4" agitated.

MISCELLANEOUS

S. S. BUBBLE CAP COLUMN, 6"x29"
RUBBER LINED TOWER, 24"x94"
FULLER ROTARY COMPRESSOR, C80.
BRAUN HEAT EXCH., 1035 sq. ft., 250 PSI.
SCRAPER CONDENSER, ALUMINUM, 8"x15".
APRON CONVEYOR, 3"x34".
FULLER KINYON PUMP 5".
S. S. RIBBON CONVEYOR, 16".
RAYMOND #1 PULVERIZER.
DIGESTERS, 3900 gal. ASME 75 PSI.
FLAKER, BLAW KNOX, 5"x6".
KOMBINATOR, S. S. Model 200.
MAGNETIC BELTS, 30"x7'5".
DAY, 3-ROLL MILL, 16"x40".
PADBLE MIXER, double shaft, 1050 gal.
DAYTON MIXER, Model 422, 100 gal.
POWDER MIXER, 2200 cu. ft.
COLTON PRESS, Model 200R.
NATIONAL TRANSIT PUMPS, 6"x18".
VACUUM RECEIVERS, 4"x54".
STILL, 600 gal., copper, 100 PSI.
PACKAGE MACHINE WRAPPER, Model N4.
MERRICK WEIGHTOMETER, 20 T.P.H.

BEST BUYS AT MEC

- 2-Bird 48" Type 347 S.S. Centrifuges, Saa. Style.
- 1-Rotax Screen 40"x120" M.D.
- 3-Lee 300 gal. Type 316 S.S. Jack. & Ag. Tanks
- 1-Bullovak 6' Jack. Vac. Crystallizer
- 3-Aluminum Bubble Cap Columns 27" and 36"
- 8-Bucket Elevators 8' to 40' overall
- 1-Devine 13 shell 40"x43" Vac. Dryer
- 1-Stokes 6 Shell 24"x36" Vac. Dryer
- 1-Stokes Dryer Double Drum 48"x108"
- 1-Buffalo Dryer Double Drum 42"x120"
- 5-Filter Press 18" to 42" Wd Plate & Frame
- 2-Sperry 38" Filter Presses, Hyd. Closures
- 8-Stainless Steel Jack. Kettles with Ag. 100 to 950 gals.
- 2-Cast Iron Jack. Kettles 250 & 800 Gals.
- 1-Stainless Steel Jack. Mixer 75 gals.
- 1-Day D-8 Jack. Mixer—800# Cap.
- 1-W & P Mixer 100 Gallon, Sigma Blades M.D.
- 3-Mikro Pulverizers 2 TH and 2 FF—10 HP.
- 1-Gründler W.B., Jr. Pulverizer 10 H.P., A.C. Motor
- 1-Robinson Size 1212, Rotary Cutter—10 HP, A.C. Motor
- 1-Raymond 16" Screen Mill—5 H.P. A.C. Motor
- 3-Stokes "T" Single Punch Tablet Machines
- 8-S.S. Tanks 100 to 5700 gals.
- 3-Horis. Steel Tanks 3000 to 12000 gals.
- 6-Stokes 212C Vac. Pumps W.C. 100 C.F.M.
- 1-Dry Jack. 30 Gal. Giant Kneader & Mixer

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I.R.—30—1000± 12 CFM	28 to 2000 CFM
Bury—200± 66 CFM	12± to 125±
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Worth—1500± 219 CFM	and
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VACUUM PUMPS

60 CFM I.R. 5-5 x 3 1/2
82 " I.R. 6-2 x 4
187 " C.P. 10 x 6
193 " Fuller Rotary
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355 " Penn. 7A—14 x 5
800 " Worth 18 x 9
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1987 " Worth 26 x 13

AMERICAN AIR COMPRESSOR CORP.
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3—32"x36" Burlovak Double Drum Dryers.
600 gal. S.S. Tank, 54"x60"
100 to 300 gal S.S. Mix Tanks, water fit.
5000 gal. S.S. Trunk Tanks, Trailered.
75 gal. Monel fit. Kettle 35"x25" agit.
100 gal. R.S. Clad Jkt. Kettles, 30"x52".
150 gal. R.S. Jkt. Kettle, 42"x94", agit.
300 gal. Pfaudler Horiz. Glass Lined Tank, 25".
4—50 gal. Steel Kettles, 75" Jkt., A.S.M.E.
Gründler W. B. Jr. Pulverizer, 10 H.P.
75 to 1500 gal. Homogenizers or Viscolizers.
20" Centrifugal Extractors, copper baskets.
48" Centrifugal Extractors, S.S. baskets & curbs.
Model 148C Stokes High Vacuum Pump, 1 1/2 H.P.
2" R.S. Centrifugal Pump, 2 H.P.
Tobart Grinder, 1 1/2 H.P.
30 ton Howe Suspension Tank Scale.

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ACCUMULATOR AND PUMPS

1—7" x 6" inverted accumulator, MP's. by Chas. Elmes Eng. Wks. 37" diel shell. Takes 11,000± ballast for 300± W.P. Max. Work. height 15'-11", 2" pipe conn. to spindle, new 1943.

2—Worthington. 4-1/2" x 6" vert. triples single acting pumps. 300± P.S.I., motor drive, less motrs, bronze trimmed, new 1943.

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2829 Cedar St. Phila. 34, Pa.

FOR SALE—WE OWN IT OR CONTROL IT!

COLUMNS—STILLS

- 2 Aluminum Bubble Cap Columns, 36" dia. x 45 plate.
- 1 Aluminum Bubble Cap Column, 27" dia. x 18 plate.
- 1 Aluminum Perforated Plate Column, 28" dia. x 36" plate.
- 1 Copper Bubble Cap Column, 42" dia. x 31 plate.
- 1 Copper Bubble Cap Column, 30" dia. x 22 plate.
- 1 Copper Column with 18—30" dia. perforated plates and 10—24" dia. bubble cap plates.
- 1 Copper Sieve Plate Column, 30" dia. x 22 plate.
- 1 Copper Perforated Plate Column 24" dia. x 14 plate.
- 1 Steel and Cast Iron Bubble Cap Column, 30" dia. x 62 plate.
- 1 Stainless Steel T316 Raschig Ring packed column, 24" dia. x 6'8" high.
- 1 Stainless Steel T316 direct fired Vacuum Still, 325 gal.

CONDENSERS—EXCHANGERS

- 3 Aluminum tub. 166 sq. ft.
- 16 Alum. Coil Exch. 96 sq. ft.
- 5 Copper tub. 65, 95, 330, 420, and 725 sq. ft.
- 3 Stainless Steel tub. 8½ 39, & 330 sq. ft.
- 4 Stainless Steel Coil Condensers, 40 sq. ft., 60 # pr.

DRYERS—EVAPORATORS

- 1 Stokes #59A Jacketed Vacuum Rotary Dryer, 18" dia. x 42" long.
- 2 Atm. Double Drum Dryers, 22" x 38".
- 1 Cummert Rotary Hot Air Dryer, 46" dia. x 26" long.
- 1 Struthers Wells Evaporator, 100 sq. ft. tube bundle.

FILTERS

- 1 Sweetland #5, 30 lvs.
- 1 Sweetland #12, 72 lvs.

- 1 Swenson Rotary Continuous Vacuum Filter; Precoat type, 8' dia. x 8' face, rubber covered and lead acid proof construction.
- 1 FEINC Rotary Vacuum Filter, string discharge, 4'6" dia. x 6' face, aluminum.

- 1 Ertel Bronze Disc Filter, 90 sq. ft.
- 4 Pressure Leaf Filters, 70 to 90 sq. ft.
- 15 Filter Presses, Cast Iron:
- 2 Shriver 36" rubber covered, closed dely., washing.
- 1 Shriver 30" rubber covered.
- 1 Shriver 30", 35 rec. pl., open dely.
- 1 Shriver 24", 40 ch., open dely., wash.
- 1 Shriver 24", 24 ch., closed dely.
- 1 Sperry 24", 15 rec. pl., open dely.
- 1 Shriver 24", 28 ch., closed dely.
- 1 Shriver 24", 12 ch. cl. dely., wash.
- 1 Louisville 8-roll Continuous Filter or Grains Press 24"

KETTLES—REACTORS

- 1 7 gal. Nickel lined Autoclave, agit.
- 1 Stainless Steel, Type 347 Autoclave or pressure tank, 250# pr., Elec. heated 850° F; 17¼" dia. x 9' high.
- 70 Stainless Steel and Stainless Clad open top, steam jacketed kettles—10, 40, 60, 80, 100, 150, 250, 500 gal. sizes.
- 1 Stainless Steel Kettle, 950 gal., 20# jkt. pr., vertical agitator, Type 347 shell, bolted C.J. top.
- 1 150 gal. Stainless Steel Steam Jacketed Kettle, open top, with double motion agitator.
- 3 300 gal. T316 Stainless Steel Jacketed Tanks, water jkt. double motion agitators.

- 1 200 gal. Read Stainless Steel Jacketed Kettle, open top, double motion agitator, 10 HP motor.

- 1 3000 gal. Horiz. Steel Cooker, Vacuum. Agitated.
- 1 4000 gal. Vertical Steel Cooker agitated.

- 2 Aluminum Reaction Kettles, Jkt. & Agit., 60 & 100 gal.

- 2 Copper Jacketed Agitated Vacuum Kettles, 4' dia. x 4' deep, double motion agitator.

MILLS—PULVERIZERS

- 1 Paul Abbee #6 Pebble Mill, porcelain lined, 32" x 36".
- 1 Abbe #4A Pebble Mill, 45" x 48".
- 1 Hardinge Conical Ball Mill, Steel Liner, 4'6" dia. x 24" long.
- 1 Williams Hammer Mill, type AK; size A, stainless steel.
- 3 Mikro Pulverizers, #1-SH, #2-S1, #2-TH.
- 1 Premier Colloid Mill, type U-3, 6" st. sl. rotor.

MIXERS—AGITATORS

- 1 Porter heavy duty jacketed double worm mixer—75 gal.
- 1 Dellenberger 100 gal. Heavy Duty Double Arm Mixer, fish-tail blades, jacketed.
- 1 Broughton Powder Mixer, double arm, 50 cu. ft.
- 10 Copper Conical Blenders, ½, 1, 7, & 11 cu. ft.

JUST PURCHASED

- 8—15,000 gal. Vertical Welded Steel Closed Fermenting Tanks, 80 lbs. W.P., turbine agitator with 40 HP motor; 970 lin. ft. 3" pipe coil. Excellent condition.

TANKS

- 1 9000 gal. Horiz. Alum. Tank—NEW
- 35 Aluminum Tanks, closed, 4, 275, 330, 480, 500, 1350 & 1450 gal.
- 2 100 gal. Glass Lined Vacuum Tanks.
- 15 Horiz. Welded Steel Tanks, Lastiglass Lined, 15,200 gal.
- 3 Horiz. Welded Steel Tanks, Lastiglass Lined, 5800 gal.
- 5 Vertical Welded Steel Tanks, closed Mammut Lined, 7000 gal. & 2300 gal.
- 1 Vertical Rubber Lined, 6000 gal. open
- 5 Vertical Jacketed Pressure Tanks—Steel—30# steam jacket—6mm vacuum internally:
- 3—34" ID x 15' H (approx. 700 gal.)
- 1—23" ID x 10' H (approx. 230 gal.)
- 1—23" ID x 9' H (approx. 195 gal.)

STAINLESS STEEL TANKS IN STOCK

- 1 16,200 gal. Vert., closed, T304—NEW
- 1 5700 gal. Horiz. T304—NEW
- 1 4200 gal. Vert., closed, T304—NEW
- 1 2350 gal. Vert., open, T302—NEW
- 1 1400 gal. Vert., open, 10' L x 57" W x 57" D
- 2 500 gal. Vert. T304—NEW
- 40 Stainless Steel Tanks—from 9 gal. to 500 gal. sizes.
- 12 3000 gal. Horizontal Stainless Steel Tanks, 5'4" dia. x 18'9" long, insulated and agitated. Excellent for transporting, storage or holding.

MISCELLANEOUS

- 2 Bird Susp. 48" Centrifugals, 48" dia. Stainless Steel Perforated Baskets.
- 1 Bird Suspended 48" Steel Centrifugal, Perforated basket; Bottom discharge.
- 1 Fletcher 30" Jr. Centrifugal Extractor, St. St. Imperi. basket.
- 1 Sharples #16 Super Centrifuge, stainless steel.
- 5 DeLaval Centrifuges, models #600, 74-11 and 94-01.
- 1 Delonizing System, 500 GPH. Zeolite.

- 2 Kux Machine Co. Model 23 Rotary Pellet Presses, 21 and 25 punch—with motor and vari-drive.

- 6 Stokes Rotary Pellet Presses, 16 punch, B-2, D-3, D-4.
- 1 Byron Jackson Deep Well Pump, 150 GPM 325' head, NEW.
- 4 Selectro Vibrating Screens, stainless steel, 2' x 7', double deck, enclosed.
- 1 Stainless Steel Horizontal Sterilizer or Steam Retort, 10# pr., 24"W x 26"H x 36"L.
- 1 Stokes Vertical Steel Jacketed Vacuum Chamber and Impregnating tank, 30"L x 25"W x 24"D.

STAINLESS STEEL FABRICATION

We have in stock a quantity of Stainless Steel sheets: Type 304—12 ga., 14 ga., and 16 ga. Tanks, receivers, etc. fabricated to your specifications.

Write: Attn. Fabricating Division.



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International Type X24 Porcelain-Lined Pebble Mills; 8' x 8' motorized.
Abbe Buhrstone-Lined Mills; 32" x 36", 54" x 60" and 60" x 72".
Buffalo 20 Shelf Vacuum Dryer; 40" x 42", complete with accessories.
Stokes 16 Shelf Steam Heated Dryers; 3' x 3', 6'10" overall.
Horizontal Dryers with tracks; 66" x 14'7" long, 2 1/2" steam pipe.
2 Stainless Drum Dryers; 5' x 10' with accessories.
Stainless (type 347) 16 Section Column; 8 1/2" x 19" high, complete with accessories.
Copper Bubble Cap Column, having 24 plates; 18" x 12" high.
STAINLESS Flash Tank, 8' x 6' with stainless tube bundle; print available.
3,000 gal. Rubber-Lined Vertical Tank, 7' x 10' with rubber-lined valves.
Croll-Reynolds Vacuum Evaporator in Monel, 30" x 5', with 2 Stage Evaporator.
Pfaunder Glass-Lined Jacketed 400 gal. Reactor.
3 Pfaunder 350 gal. Jacketed Agitated Kettles.
2 Pfaunder Glass-Lined Jacketed 150 gal. Evaporating Dishes; 60" x 4".
Ball & Jewell Stainless Rotary Cutter No. 1 1/2 with 40 HP.
Lancaster Model EAG4 Double Muller Mixer; 10 HP, complete.

Robinson Unique STAINLESS Mixer with Sifter; 17" x 30" x 20"; 2 HP.
NEW STAINLESS Double Ribbon Mixer; 24" x 96"; 24 cu. ft.
J. H. Day JUMBO Mixer; 44" x 78" x 52".
J. H. Day 5 gal. STAINLESS Double Arm Jacketed Mixer; Vac. cover.
Baker Perkins STAINLESS Sigma Mixer; 6" x 12"; 2 HP XPL motor.
W. & P. type 100 gal. working Jacketed Double Arm Mixers.
Buflovak 500 gal. Steel Jacketed and Agitated Kettle.
MONEL 250 gal. Jacketed and Agitated Reactor with access.
Stainless Reactors from 24" x 40" to 48" x 60".
Type 347 Stainless Reactor 18" x 24"; Jktd. and Agtd.
2,000 gal. Copper Coil Heated Vacuum Pan; 7' x 10'7".
Goslin Birmingham Steel Sextuple Effect Evaporator.
Swenson Quadruple Effect Long Tube Film Type Evaporator.
Zarembo Single Effect Cast Iron Evaporator; 130 sq. ft.
Swenson Jacketed Crystallizers; 24" x 10' and 24" x 12'; 5 HP.
2 Bird Rubber Covered 48" Centrifugals; 2 speed 40 HP motors.
Bird Young Rotary Vacuum Filters with S.S. Screens, 4' x 4'.

FRED R. FIRSTENBERG, President

FIRST MACHINERY CORP.

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SURPLUS EQUIPMENT

Latest Type Metallurgical and Chemical Equipment Excellent Condition

Hardinge Conical Ball Mill 10' x 48"
Vulcan Rotary Kiln 8' dia. x 80'
Research Corp. Electrostatic Precipitator
Ruggles-Coles Class XA-1 Dryer
Dorr Causticizing Equipment
Oliver Rotary Vacuum Filters A1
Dorr Type A Thickeners
Sampling Mill—Crusher, Rolls, Samplers

Link Belt Screw & Belt Conveyors
Turbo Mixer Agitators
Norblo & Sly Dust Collectors
Hardinge Feedometers
Oliver, Dorr, Morris, Worthington process pumps
Tanks and Bins
Instruments and Controls

The above items include all auxiliary equipment with individual motor and control 220/440/3/60. The equipment may be inspected on foundations.

Complete List with Specifications Available.

THE VULCAN DETINNING CO.
SEWAREN, N. J.

CLASSIFIERS: 4—Akins and Wemco 54" and 78", single screw, double pitch, weir type, 220/440 volt motors, all in new condition. Three of the above located near Reno, Nev.

DRYERS or KILNS: 2—10 ft. x 90 ft., heavy duty, with or without auxiliary equipment, condition like NEW. One located in Minnesota. 2—Kilns 7 1/2' x 125 with Fuller Lehigh grate type coolers 3'6" x 16" with or without all auxiliary equipment.

AIR SEPARATORS: One Bradley and one Sturtevant 16 ft., with or without 100 H.P., 440 volt, motor.

PULVERIZERS: Hardinge Mill size 5 ft. x 22", steel lined, complete with disc feeder and 30 H.P. motor. 1—Sturtevant 1 1/2 Ring Roll Mill. 1—3' x 4' Elmo Ball Mill complete with liners, ball charge, V-belt drive and 20 H.P. motor and control. NEW condition. One Marcy Rod Mill 8' x 12' and one 5' x 14', manganese lined, with motors and drive.

BLOWERS: 2—Roots Connersville 18" x 54", 7000 CFM @ 2 lbs., 75 HP, A.C. Motors. New Condition.

COMPRESSORS: Worthington DC2, 29/16-1/2 x 21, 600 H.P. synchronous motor, 440 volt, with all auxiliary equipment.

LOCOMOTIVE CRANE: Link Belt, 15 ton capacity, standard R.R. gauge, gasoline powered.

A. J. O'NEILL

Lansdowne, Pa.

Phila. Phones: MAdison 3-8300—3-8301

HARDINGE MILLS 7' x 48", 8' x 22", 10' x 48" w/motors.

SCREENS—18 x 48 double Selectro w/motor. Tyler hummer 3 x 5 single/double/triple.

HAMMER MILLS—Wms. LG 1, BX 825.

PULVERIZERS—Sturtevant 1 1/2 Ring—Bradley Hercules Jr.

TUBE MILLS—5' x 22" Silex.

SEPARATOR—Raymond 6' Wizzer.

ROTARY KILNS—5' x 40', 6' x 80', 7 1/2' x 285', 4' x 30'.

CRUSHERS, JAW—8 x 11, 11 x 14, 11 x 20, 12 x 28, 24 x 36.

DUMP CARS—2 yd.—36" ga. w/loco.

Filter PRESSES—Shriver 24" x 28 P&F—Closed, 30" w/20P&F open, washing. 30" Shriver w/30P&F closed washing.

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Industrial — Chemical Process
Equipment

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DRYERS—KILNS

- 1—Vulcan 8' x 135', $\frac{5}{8}$ " shell, 2-14" tires, complete.
- 1—Vulcan 8' x 115', $\frac{5}{8}$ " shell, 2-14" tires, complete.
- 2—Vulcan 7' x 160', 7' x 110', $\frac{5}{8}$ " shell, 2-12" tires, complete.
- 1—Allis-Chalmers 10' x 90', 9 16" shell, 2-14" tires, complete.
- 1—6' x 60', $\frac{3}{4}$ " shell, 2-8" tires, complete.
- 1—Vulcan 4½' x 50', $\frac{3}{8}$ " shell, 2-6" tires, complete.
- 2—Link Belt 27" x 8' monel, 27" x 10' steel, Roto-Louvre Dryers.
- 6—Rotary Dryers 7' x 70', 7' x 60', 5' x 67', 4'6" x 40', 4' x 25'.
- 3—Louisville Rotary Steam Tube Dryers 6' x 50', 6' x 30', 3' x 27'.
- 1—Louisville Rotary Steam Tube Dryer 6' x 27', S.S. tubes.
- 2—Devine 17 shelf double door vacuum Dryers 59" x 78".
- 1—Devine 6 shelf Vacuum Dryer 40" x 43".
- 5—Stokes & Bufflovak Rotary Vacuum Dryers 30" x 8', 3' x 15', 6'6" x 38".
- 5—Bufflovak 60" x 144", 42" x 120", 32" x 90" Atmospheric Double Drum.
- 1—Single Drum 60" x 80" Flaker.
- 1—14 Truck steam heated Dryer 1680 sq. ft.

FILTERS

- 6—Vallez Pressure Filters 360 and 540 sq. ft.
- 1—Sweetland #12 with 36 leaves.
- 1—Sweetland #10 with 36 steel leaves.
- 1—Sweetland #7 with 27 steel leaves.
- 8—Oliver Rotary Vacuum 11'6" x 14', 8' x 12', 8' x 10', 8' x 8', 5'3" x 6', 3' x 1'.
- 3—Eimco Rotary Vac. 8' x 8', 4' x 5', 4' x 4'.
- 1—Oliver 8' x 8' Rotary Precoat Filter, rubber-lined.
- 1—Feinc Rotary Vacuum 8' x 12' steel with drive, etc.
- 3—Shriver 36" P&F, 30 chambers, c.i., closed delivery.
- 1—Sperry 36" Recessed, 48 chambers, c.i., open delivery.
- 5—Shriver 30" P&F, 30 chambers, c.i., open delivery.
- 8—Sperry 24" P&F, 16 chambers, c.i., closed delivery.
- 1—Shriver 24" Recessed, 30 chambers, c.i., open delivery.
- 3—Shriver 18" Recessed, 30 chambers, c.i., open delivery.
- 2—Sperry Aluminum 30" and 24" P&F, 22 and 26 chambers.
- 10—Shriver, Sperry Filter Press Skeletons 42" to 18".

CENTRIFUGALS

- 1—Fletcher 48" Suspended Aluminum bottom discharge, perforated basket, motor driven.
- 1—Fletcher 40" center slung, rubber covered, perforated basket.
- 1—Tolhurst 48" center slung, SS perforated basket.
- 1—Tolhurst 32" Suspended Monel, bottom discharge, perforated.
- 1—Tolhurst 26" suspended Monel, bottom discharge, perforated.
- 1—AT&M 42" Suspended S.S., bottom discharge, perforated.
- 6—AT&M 40" Bronze Baskets, bottom discharge, perforated.
- 1—Fletcher 40" Suspended, Bottom Discharge, S.S., perforated basket.
- 1—Sharples C20, 316 SS Super-D-Hydrator.
- 1—Bird 36" x 50" solid bowl, stainless.
- 2—Bird 36" x 50" solid bowl, rubber and stainless.

FOR YOUR SPECIAL CONSIDERATION

SPECIALS

- 1—Ruggles Cole Class XH14 parallel flow Dryer 90" x 60" NEW.
- 2—Oliver monel 8' x 10' Rotary Vac. Filters.
- 2—Oliver 5'3" x 3' Rotary Vacuum Enclosed Precoat Filters.
- 1—Rogers Spray Dryer 16" dia. with all accessories.
- 2—Pfaudler 100 gal. glass-lined Stills with Condensers.
- 3—Steel 2000 gal. jacketed, agitated, 200 PSI Reactors.
- 1—Pfaudler 350 gal. glass-lined, jacketed, agitated Reactor.
- 3—Dopp 250, 150 gal. jacketed, agitated Kettles.
- 3—Rotex #42 Double Deck Screens 40" x 84".
- 1—Bufflovak VRC, S.S. Single Effect Evaporator 94 sq. ft.
- 1—Swenson Quadruple Effect Evaporator S.S. 2600 sq. ft.
- 1—Bufflovak 6' dia. Vacuum Crystallizer.
- 1—Hardinge 4½' x 16" Conical steel-lined Ball Mill 30 HP motor.
- 1—Vertical Storage Tank 30' dia. 26' high, 135,000 gal.
- 1—Bird 18" x 28" steel solid bowl Centrifugals.
- 2—Sharples #16-P Monel Pressure-tite Centrifuges.

PULVERIZERS

- 2—Raymond 4 roll High Side Mills, complete.
- 1—Bauer 36" Attrition Mill 2-50 HP motors.
- 17—Patterson, Abbe Pebble & Ball Mills 60 to 1000 gals.
- 2—Premier Colloid Mills 8" dia., S.S.
- 1—Eppenbach QV7 Colloid Mill.
- 2—Jeffrey 36" x 24", 20" x 12" Hammer Mills.
- 3—Raymond, Gayco Mechanical Separators 14", 12", 4", 3'.
- 1—2 Roll Rubber Mill 6" x 12".
- 2—Mikro No. 15L, No. 15H Pulverizers.
- 1—Fitzpatrick Comminuting Mill 5 HP.

SCREENS

- 1—Selectro S.S. double deck 4' x 10'.
- 5—Sprout Waldron S.S. single deck, 40" x 84".
- 1—Robinson Triple Deck 40" x 104".
- 4—Tyler Hummer 3' x 15', 3' x 10', 4' x 7' Single Deck.
- 5—Tyler Hummer 3' x 5' Triple Deck.
- 1—Abbe #2 Blutegess Sifter.

MIXERS—ALL TYPES

- 7—Baker Perkins 200, 100, 50 and 20 gal. Jacketed, Double Arm, Sigma Blades.
- 1—Baker Perkins 300 gal. Unidror S.S.
- 1—Baker Perkins ½ gal. jacketed.
- 1—Baker Perkins, type JNM, 100 gal., jacketed, double arm.
- 1—Day 30 gal. Imperial jacketed, double arm.
- 10—Rogers 200# to 3000# Powder Mixers.
- 12—Electric, Portable Agitators ¼ HP to 5 HP, NEW.
- 4—Day, Ross, 8 and 50 gal. Pany Mixers.

MISCELLANEOUS

- 20—Bucket Elevators, steel housing, 34" to 90" centers, 8" x 5" to 24" x 8" buckets.
- 7—Stokes Vacuum Pumps 15 to 100 CFM.
- 1—Milton Roy Proportioner Pump, S.S. and Hastelloy, 10 GPM.
- 5—Devine, Bufflovak, Condensers and Receivers, 20 to 90 sq. ft.
- 7—Groen 150, 125 gal., S.S., jacketed, agitated, kettles.
- 4—Stokes DD2, D4 Rotary Tablet Machines.
- 5—38" dia. Stainless Steel Revolving Pans.
- 2—Nash AL671 Vacuum Pumps 20 cfm.
- 10—Olivite, Duriron, Rubber, Durimet and Haveg Centrifugal Pumps 1½" to 4".



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Capem E4F 4-Head Rotary Capper.

Island Equipment Styline automatic Bottle Unscrambler.

CRCO New Way MH Wraparound Labeler.

S. & S. G1, G2, G6 Auger Fillers.

Stokes and Smith Model HG88 Duplex Auger Powder Filler.

Colton 2 and 3RP Rotary Tablet Machines.

Stokes 2C Cream Filler and Closer.

Triangle Elec-Tri-Pak G2C, A6CA Fillers.

Filler 4-Head Stainless Steel Filler.

Horix S. S. 14-Head Rotary Filler.

Standard Knapp No. 429 Carton Sealer.

Mikro 4TH, 3TH, 1SH Pulverizers; Jay Bee U1, Schutz O'Neill Mills.

Tri-Homo #5 Colloid Mill, 7½ HP.

3500 Gal. working cap. Steam Jacketed, Double Arm Mixing Tanks for mixing, storing or processing of your materials.

B. P. 150 gal. Unidor S.J. D.A. Mixer.

Stokes, Day, New Era, Hottman Mixers, from 2 to 450 gal., with and without Jackets, Single, Double Arm Agitators.

Baker Perkins and Readco Heavy Duty 5 to 150 gals. Double Arm Jacketed Mixers with Sigma or Fish Tail Blades.

Day 100, 800, 1500, 2500 lbs. Dry Powder Mixers and Sifters.

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Established 1912

Ross, Day, Pony Mixers, 8, 15 gal. caps.

Acme 150 gal., and Lee 85 gal. S. S. Jacketed Mixing Kettles.

Huhn Steam and Gas Fired Rotary Dryers.

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PARTIAL LIST—Send for complete listing

- | | |
|--|---|
| 1—5' x 36" Hardinge buhrstone lined continuous Pebble Mill. | 5—3000 gal. Plaudler jacketed glass lined (dairy) vertical Tanks. |
| 3—5' x 12" Bullovac double drum Atmospheric Dryers. | 50—Stainless steel Tanks (New and Used) up to 1000 gallons. |
| 1—30" Tolhurst impervious basket suspended Centrifugal. | 30—S.S. steam jacketed Kettles (new and used) up to 150 gallons. |
| 1—250 gal. working capacity Readco stainless steel double arm sigma blade Mixer with 50 hp. M.D. | 4—H. Day 40 gallon Pony Mixers. |
| 1—12 x 24" Farrel-Birmingham 2-roll Rubber Mill with 25 hp. drive. | 12—Filter Presses—recessed and plate and frame—from 7" to 30". |
| 1—New 3000 gal. vertical S.S. Storage Tank. | 1—20 gal. Stokes S.S. Vacuum Pan. |
| 1—Bullovac triple effect Evaporator, 300 sq. ft. per effect. | 1—Day 3000 lb. jacketed Powder Mixer. |
| 1—Plaudler 3' S.S. vert. tube Vacuum Pan. | 5—Day 12 x 32" 3-roll Mills. |
| 3—Devine 3-shell 42" x 42" vacuum shell Dryers. | 3—Double drum Atmospheric Dryers—42 x 120", 32 x 90", 24x80". |
| 2—New Simpson #200 Intensive Mixers with S.S. bowls and plows. | 6—8' x 40" Rotary Hot Air Dryers. |
| | 8—Dry Powder Mixers—100 to 3000 lb. cap. |
| | 1—Bullovac 3-shell 42 x 42" Vacuum Shell Dryer. |

- | |
|--|
| 1—New Ing-Band 14" x 7" Vacuum Pump. |
| 1—Harris 6' stainless steel Vacuum Pan. |
| 1—New Premier 3" stainless steel Colloid Mill with 7½ hp. motor. |
| 1—Charlotte M-15 stainless steel Colloid Mill with 15 hp. motor. |
| 2—Union Steam Pump stainless steel Reciprocating Pump, 60 GPM. |
| 2—De Laval 54-81 motor driven Clarifiers. |
| 3—Clarifiers—Sharpley airtight, stain. steel, 3 hp. |
| 2—Steel Tanks—2000 gal. heavy duty steam jacketed, open top. |
| 6—Agitators: Hettco WT-27, stain. steel turbine type. |
| 1—Disintegrator: Riets 40 3 hp. |
| 1—Evaporator: New stain. steel, 3000 lb. per hr. evaporation. |
| 1—Vacuum Pan, 26" Monjonnier stain. steel. |
| 2—Intensive Mixers: Simpson 24" double muller, motor driven. |

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14—8,000 & 10,000 Gal. R.R. Car Tanks.
6—1,000, 5,000 & 10,000 Bbl. Vert.
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- A T & T 600 Type 316 SS centrifuge
2 Bullovac Vac. Shelf Dryers—20 shelves 36" x 42" complete units with condenser, vac. pump & motor
3—30 gal. Reactors Jkt'd & Agtd Glass lined & type 347 SS throughout with condensers
Day Lab. 5 gal. Vac. Mixer SS Jkt'd—Sigma Arms Ball & Jewel size 1½ SS Rotary Cutter, 40 HP
Stokes 48" x 108" Double Drum Dryer complete
Buffalo 42" x 120" Double Drum Dryer complete
Mikro 25 Atomizer complete with 20 HP motor
Mikro Pulverizers from Santum to 24
5—Abbe Belgian Block Mills—5' x 6' & 4½' x 9'
2—Brewer SS Spray Dryers—7' x 8½' & 6' x 9'
2—Ross 40 Gal. Mammoth Pony Mixers
New, Used & Rebuilt Ribbon Blenders Steel & SS.
New, Used & Rebuilt Reactors—Glass & SS.
All sizes—Send Us Your Specifications
New & Used Kettles, all metals & Sizes

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GELB GIVES TOP VALUES



THE GELB GIRL OCTOBER, 1952

- | | |
|--|---|
| <ul style="list-style-type: none"> 1—Abbe #2 Master Rotary Cutter. 1—Throp 3-Roll Calendar, 18" x 54". 1—Sparkler Monel Jacketed Filter, Model #33-S-28. 1—Sparkler Steel Jacketed Filter, Model #33-D-7. 1—Sperry Aluminum 42" x 42" Plate & Frame Filter Press, 34 Chambers, Closed Delivery, 5" Frames "Unused". 1—Shriver Stainless Steel 24" x 24" Filter Press, 10 Chambers, 4 Eye, Closed Delivery. | <ul style="list-style-type: none"> 3—Shriver Aluminum 24" x 24" Plate & Frame Filter Presses, 35 Chambers, Closed Delivery, 1" Frames. 1—Vulcan Rotary Kiln, 7' x 120' x 60', Type 2A-14, "New". 1—Ruggles Cole Rotary Dryer, 7'6" x 60', Type 2A-14, "New". 2—Bullovak Double Door Vacuum Shelf Dryers, 20 Shelves, size of shelves 5' x 160". 1—Stokes Vacuum Shelf Dryer, Model #138-H-12, 12 Shelves. 1—J. P. Devine Vacuum Shelf Dryer, 9 Shelves. |
|--|---|

DRYERS—KILNS

- 1—Louisville Rotary Steam Tube Dryer, 6' x 50'.
- 1—Rotary Kiln, 5' x 54'.
- 1—Jabes Rotary Dryer, 40½" x 11'8".
- 1—Monel Rotary Dryer, 3' x 24'.
- 1—Hahn Rotary Steam Tube Dryer, 3' x 12'.
- 2—Bullovak Vacuum Drum Dryers, 24" x 20".
- 1—Bullovak Stainless Steel Double Drum Dryer, 6" x 8".
- 1—Bullovak Stainless Steel Vacuum Double Drum Dryer, 6" x 8".
- 2—Bullovak Double Drum Dryers, 5" x 12'.
- 1—Bullovak Double Drum Dryer, 32" x 90".
- 1—J. P. Devine Vacuum Dryer, 5' x 25'.

FILTERS

- 1—Shriver 42" x 42" Evudur (Bronze) Plate & Frame Filter Press, 40 Chambers, Closed Delivery.
- 1—Sperry 42" x 42" Cast Iron Plate & Frame Filter Press, 18 Chambers, Closed Delivery.
- 1—Shriver 36" x 36" Cast Iron Plate & Frame Filter Press, Steam Jacketed, 48 Chambers, Closed Delivery.
- 3—Shriver 38" x 36" Cast Iron Plate & Frame Filter Presses, Closed Delivery, 24 & 25 Chambers.
- 4—Sperry 12" x 12" Cast Iron Plate & Frame Filter Presses, 12 and 20 Chambers.
- 1—Valles Filter #2-B.
- 2—Sweetland Filters, #2, 5, 7 and 12.
- 2—Oliver Rotary Vacuum Filters, 5'3" x 6', Steel construction with monel screens.

CENTRIFUGALS

- 1—A. T. & M. 40" Rubber Lined Center Slung Centrifuge, Perforated Basket with Explosion Proof Motor.
- 2—A. T. & M. Stainless Steel Suspended Type Centrifuges, 48" Imperforated Baskets with motors.
- 1—A. T. & M. Stainless Steel Suspended Type Centrifuge, 34" Imperforated Basket with motors.
- 2—Fletcher 40" Whirlwind Centrifuges, Bronze Perforated Basket with Explosion Proof Motors.

- 1—Tolhurst Stainless Steel Suspended Type Centrifuge, 40" Imperforated Basket.
- 1—Fletcher 48" Whirlwind Centrifuge, Bronze Perforated Basket with Explosion Proof Motor.
- 1—Tolhurst Center Slung Centrifuge, 36" Perforated Steel Basket with Explosion Proof Motor.
- 1—Sharples Stainless Steel Super D Center, Model PN-14.
- 1—Bird Solid Bowl Stainless Steel Continuous Centrifuge, 18" x 28".
- 6—Sharples #16-Y Stainless Steel Super Clarifying Centrifuges.

MIXERS

- 2—Banbury Mixers #1 and #9.
- 12—Simpson #20 Intensive Mixers "Unused".
- 1—Simpson #21 Intensive Mixer.
- 1—Readco Stainless Steel Jacketed Double Arm Jacketed Mixer, Sigma Blades, 225 Gals.
- 4—Baker Perkins Steel Jacketed Mixers, Sigma Blades, 100 Gals.
- 3—Baker Perkins Stainless Steel Jacketed Mixers, Sigma Blades, 100 Gals.
- 1—Cavagnaro Loomis Stainless Steel Jacketed Vacuum Mixer, Fish Tail Blades, 100 Gals.
- 1—Baker Perkins Jacketed Mixer, Sigma Blades, 50 Gals.
- 1—J. H. Day Jacketed Mixer, Sigma Blades, 30 Gals.
- 1—Readco Jacketed Vacuum Mixer, Sigma Blades, 2½ Gals.
- 3—J. H. Day Mogul Vacuum Mixers, Sigma Blades, 2½ and 5 Gals.
- 1—J. H. Day Jacketed Powder Mixer, 5000 lbs. Center Discharge.
- 2—J. H. Day Powder Mixers, 2000 lbs.
- 4—Turbo Steel Jacketed Mixers, 700 Gals. Each.

PULVERIZERS—GRINDERS—MILLS

- 1—Mikro #3TH Mikro Pulverizer with 30 HP Motor.
- 1—Mikro #3-W Pulverizer
- 1—Mikro #2TH Pulverizer, Stainless Steel & Bronze Construction, with Motor.
- 2—Mikro #15H Pulverizers with Motors.

- 1—Mikro Bantam Pulverizer.
- 1—Ball & Jewell #20 Stainless Steel Rotary Cutter.
- 2—Ball & Jewell #2 Rotary Cutter.
- 1—Blaw Knox Air Mill Pulverizer.
- 1—Mikro Stainless Steel Atomizer #6.
- 3—Throp 2-Roll Rubber Mills, 18" x 50".
- 1—Abbe #2 Buhrstone lined Pebble Mill, 5' x 4'.
- 1—Smidth Iron lined Tube Mill, 4' x 12'.
- 1—Grundler #24-40 Hammer Mill.

AUTOClaves—KETTLES—TANKS

- 2—Blaw Knox Steel Jacketed Autoclaves, 300 & 500 Gals. Cap., Working Pressure 500 Lbs.
- 1—Patterson Steel Jacketed Autoclave, 900 Gals. Cap., Internal Pressure 120 Lbs.
- 1—Stainless Steel High Pressure Autoclave, 10 Gals. Cap., 250 Lbs. Internal Pressure.
- 1—Combustion Engr. Stainless Steel Jacketed Autoclave, 500 Gals. Cap., 300 PSI.
- 1—Glascote Glass Lined Jacketed Vacuum Reactor, 1800 Gal. Cap., "Unused".
- 1—Plaudier Glass Lined Jacketed Vacuum Reactor, 500 Gals. Cap.
- 12—Koven Stainless Steel Jacketed Vacuum Kettles, 380 Gals. Cap.
- 1—Koven Stainless Steel Storage Tank, 1200 Gals. Cap.
- 1—Koven Steel Mixing Tank, 1200 Gals. Cap. with Netico Drive, 10 HP Explosion Proof Motor, Turbin Agitator.
- 1—Artesian Steel Jacketed Kettle, 1,000 Gals. Cap., with Rake Type Agitator, ASME Code, 50 Lbs. Pressure.
- 2—J. P. Devine Jacketed Vacuum Reactors, 2,000 Gals. Cap. Each.
- 1—Lee Stainless Steel Jacketed Kettle Type C, 10 Gals. Cap., 125 Lbs. Jacketed.
- 3—Buffalo Steel Pressure Tanks, 1,800 & 10,000 Gals. Cap., 100 & 125 PSI, ASME Code.
- 2—Steel Storage Tanks, 6,700 Gals. Cap. Each, 80 PSI.
- 10—Steel Fermenting Tanks, 1300 Gals. Each, with Coils & Agitators, 80 PSI.
- 25—Steel Storage Tanks, 9,000-17,500 Gals. Cap.
- 1—Steel Rubber Lined Storage Tank, 4,500 Gals. Cap.

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DOPP 350 gal. Agitated Jacketed, Vac. Kettle, Condenser & Pump

DRYERS & KILNS
Devine #12 Vac. Shelf Dryer, 40"x32" shelves.
2—Ruggles Coles 7 1/2' x 60' x 45' Rotary Dryers.
1—Allis-Chalmers 10' x 90' Rotary Kiln.
1—Ruggles Coles 54" x 25' Rotary Dryer.
New Rotary Dryers, Kilns & Coolers built to order.
2—Proctor 6 fan automatic Conveyor Dryers.
2—Albright-Neil 7' x 5' Atmos. Drum Dryers.
1—Buffalo Vac. Drum Dryer 24" x 26" Rotary Vac. Dryers & Vac. Shelf Dryers.
1—Steam, Gas & Electric Dryers, Tray & Truck.

CENTRIFUGALS & CENTRIFUGES
5—Tolhurst 40" Suspended Type Centrifugals. Bottom Discharge, Motor Driven.
6—Centrifugals 20", 30", 40", Steel, Copper, Stainless & Rubber Lined.
12—Sharpley Centrifuges #5A Stainless. Also #6.
3—De Laval Multiple Clarifiers #200, 300 & 301.

FILTERS
1—Valley 41 Stainless Covered Leaf Filter, type 49.
10—Sperry & Shriver 12", 18", 24", 30", 36", Iron Filter Presses. Also 12" Bronze.
Sewall & Oliver Rotary Vac. Filters.

KETTLES & TANKS
1—Dopp 350 gal. CI Agit. Jack. Vac. Kettle. Devine 36" dia. Imping. Unit, closed Jack-Liquor & Impreg. Kettles. Also 100 gal. size.
Devine 1000 gal. closed jack agit. steel Kettle.
1—200 gal. vert. agit. Jack Steel Kettle.
8—Jacketed Kettles 50 to 2500 gals.
1—250 gal. Lead Lined Kettle.
1—1000 gal. Stainless Agitated Tank.
2—Plauder 500 gal. vert. Glass Lined Tanks.
4—10,000 & 4,000 gal. Stainless Steel Tanks.
New Stainless Steel Tanks 50 to 3000 gals.
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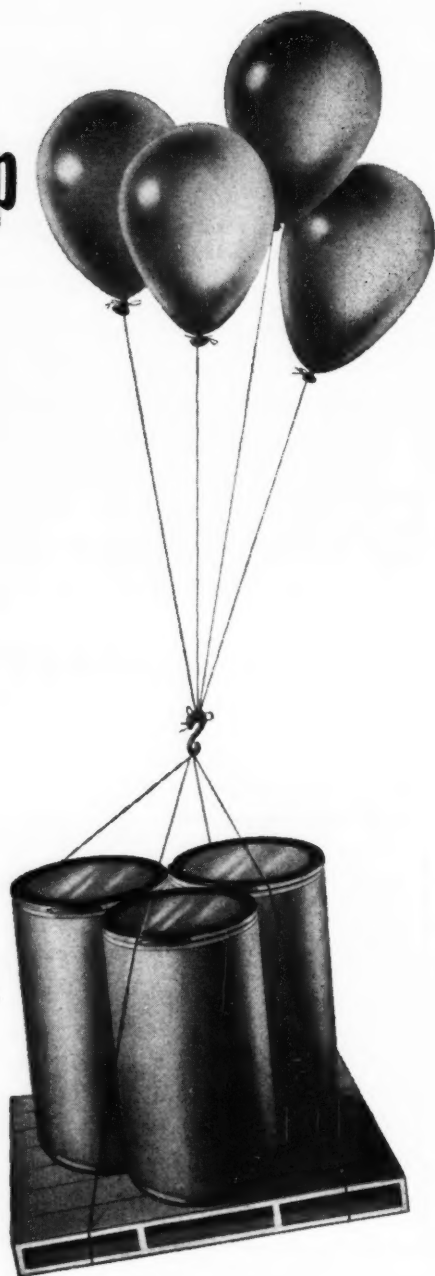
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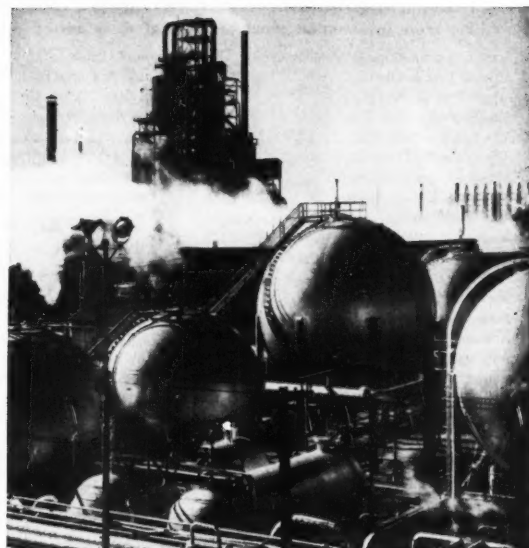
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Unit Heaters—Have boiler tube design, are gas fired. The Trane Co.	102
Portable Oven—Operates over temperature range from 300 to 1,000 deg. F. Grieve-Hendry Co., Inc.	103
Centrifugal Humidifier—Is easily installed, suspends from overhead. Bahnson Co.	104
Dehumidifier—Automatically controls humidity in storage areas. Desomatic Products Div., Daly, Merritt & Sullivan, Inc.	105
Roof Ventilator—Fiberglass-reinforced resin provides corrosion resistance. Iron Lung Ventilator Co.	106
Heat Machine—Model VO-168 has output of 130,000 to 165,000 Btu. per hr. Fagcol Heat Machine Co.	107
Fan Ventilator—Has special low type design for good appearance. The Burt Mfg. Co.	108
Relief Valves—New 202 series for use on hot water tanks and heaters. McDonnell & Miller, Inc.	109

New Processing Equipment

Grinding Brick—Made of high density porcelain gives improved milling. McDaniel Refractories	110
Autoclave Agitator—Driven by external magnet, eliminates stuffing box. Chemtech Products Corp.	111
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Radioactive Scaler—Utility model SC-19 is simple, low cost. Tracerlab, Inc.	122
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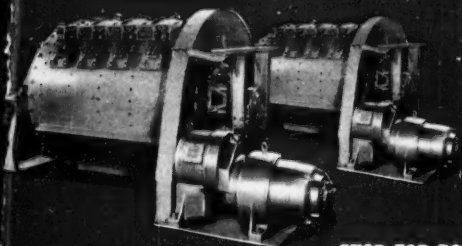
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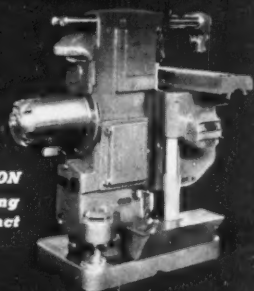


STOP FOR POSITION

Stop at the desired point for quickly and conveniently loading and unloading

SPEED UP PRODUCTION

Save time by stopping quickly with a compact integral brake unit

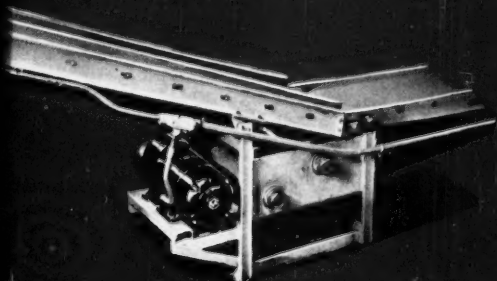


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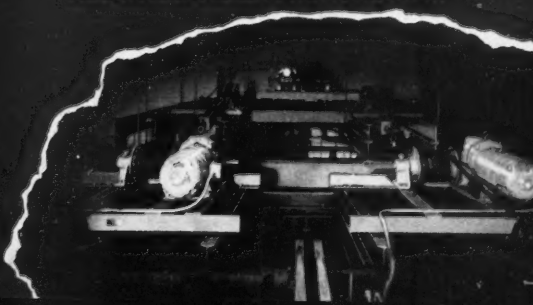


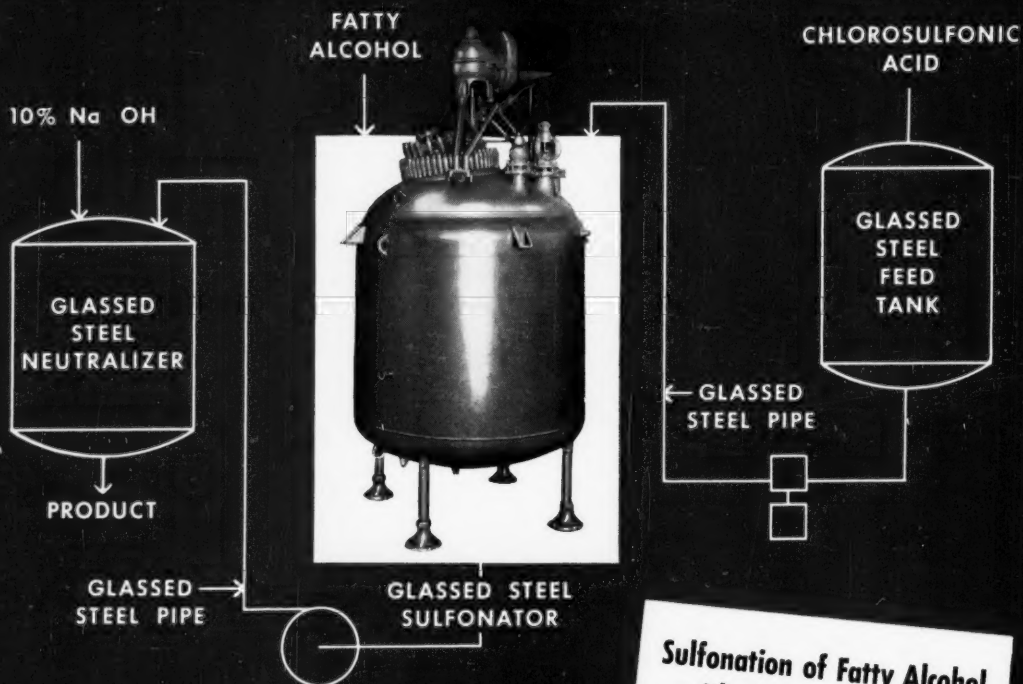
STOP AND HOLD ANY LOAD

Unibrake motors are very advantageous on hoist, elevators, inclined conveyors, etc. ...

STOP FOR SAFETY

Reduce the hazard of injury to workmen or damage to equipment which might cripple vital production





To process with CHLOROSULFONIC ACID, you need

the corrosion resistance of glass
plus **the working strength of steel**

Pfaudler glassed steel is not attacked by chlorosulfonic acid at any temperature at which this highly corrosive material is used. For this reason, glassed steel permits full-scale operation of many processes which otherwise might never move out of the laboratory. The fatty alcohol sulfonation shown above, for example, is accomplished much more efficiently with chlorosulfonic than with other acids which might have been used. Without glassed steel equipment, it would not have been feasible to use this more efficient process.

Pfaudler glassed steel is resistant to all acids except hydrofluoric, even at elevated temperatures and pressures. With a new Pfaudler glass, it is possible to handle not only acids but also alkaline solutions up to a pH of 12 and 212°F. Now, it is possible to perform both acid reactions and neutralizations in glassed steel vessels, as illustrated in the flow diagram above.

To give it working strength, Pfaudler glass is fused

to steel in huge furnaces at temperatures of 1500 to 1700°F. This high-temperature firing locks the glass to the steel and makes it hard and tough.

Pfaudler glassed steel reactors, in capacities from 5 to 3500 gallons and for internal pressures as high as 200 p.s.i., are commonplace in chemical processing today. These units are equipped with agitation, are usually jacketed, and are supplemented by a complete line of glassed steel pipe, fittings, and valves. Custom-built vessels as large as 8300 gallons, for severe chemical service, have been constructed. Glassed steel columns and evaporators solve many serious corrosion problems.

Whenever you have an equipment problem requiring corrosion resistance, durability, and versatility, as well as the economy which these features provide, look to Pfaudler glassed steel for the solution.

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